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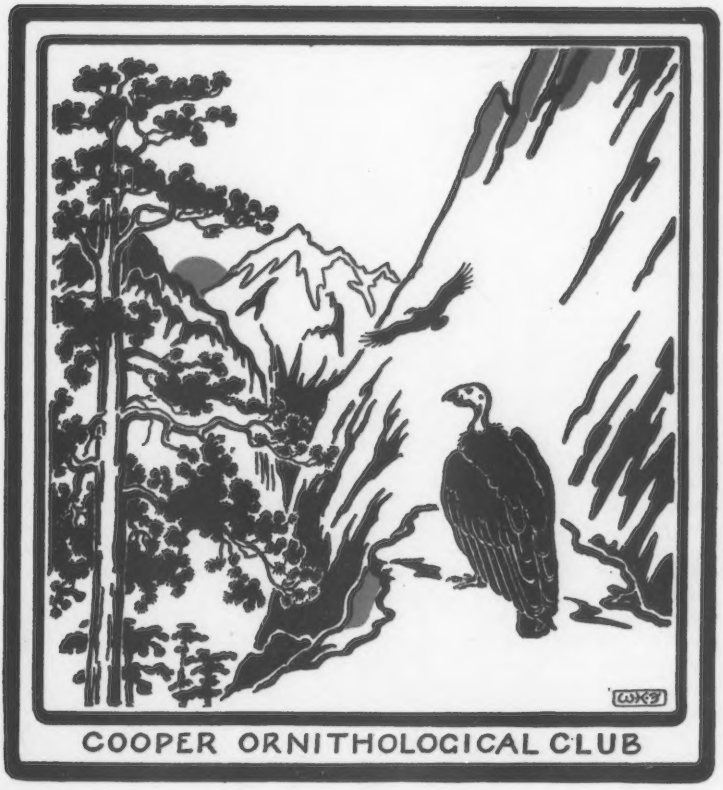
THE CONDOR

A Magazine of Western Ornithology

Volume XLII November-December, 1940 Number 6



COOPER ORNITHOLOGICAL CLUB

THE CONDOR

A Magazine of Western Ornithology

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THE CONDOR

VOLUME XLII NOVEMBER-DECEMBER, 1940 NUMBER 6

PAIR-FORMATION IN BIRDS

By DAVID LACK

There is probably more ignorance concerning pair-formation than there is of any other aspect of bird behavior. This paper attempts to summarize existing knowledge on this subject in order to stimulate further work. I am greatly indebted to Dr. Ernst Mayr and Dr. G. Kingsley Noble for their stimulating discussions with me, and to Dr. Alden H. Miller for seeing the paper through the press, an undertaking which was rendered necessary by the international situation.

A review such as the present one involves a large number of references. Papers contributing to the general discussion are cited in the standard way, but if those dealing primarily with a particular species were treated in the same manner, the text would be heavily encumbered with authors' names and years of publication. Hence papers of the latter type are listed at the end of the paper (p. 284) under the species concerned and are not referred to elsewhere. While this means a little extra trouble for the reader, it saves considerable space. Further, where one recent paper summarizes previous work on a species, I have usually thought it unnecessary to give the earlier references as well. The references are not a complete bibliography of bird courtship; only papers dealing explicitly with pair-formation are included, and in this field I have omitted many articles on typically territorial species of passerine birds, as these are now too well known to need detailed reference. In such a wide field, some references to pair-formation have almost certainly been overlooked, but in other instances omission has been deliberate where, as with the Ostrich (*Struthio camelus*), Great Bustard (*Otis tarda*) and others, the descriptions are too vague to be of value.

LENGTH OF THE PAIRING BOND

This section owes much to the sound classification by Heinroth (1928). Birds fall into five main groups: those in which the sexes (1) meet solely for copulation, (2) have a bond simply for a few days at the time of copulation, (3) form into pairs some time before copulation but separate shortly afterward (ducks), (4) remain paired for the raising of the brood or for the breeding season, or (5) pair for life. (The few species which breed in groups, and do not form pairs at all, are discussed later.)

1. *Sexes meeting solely for copulation.*—(a) All species which meet at communal display grounds or "leks"; among gallinaceous birds, Blackcock (*Lyrurus tetrix*), prairie chickens (*Tympanuchus*), Sharp-tailed Grouse (*Pedioecetes phasianellus*), and Sage Hen (*Centrocercus urophasianus*); among wading birds the Ruff (*Philomachus pugnax*) and Great Snipe (*Capella media*); among passerine birds, two genera of birds of paradise, *Paradisaea* and *Parotia* (information from Mayr), one of the bower-birds (*Priondura newtoni*), the Cock-of-the-rock (*Rupicola*), Gould Manakin (*Manacus vitellinus*); and among hummingbirds, *Phaethornis superciliosus* and *P. guyi*, and *Pygmornis longuemareus*. The birds in this group form a striking example of convergent evolution in behavior.

(b) Various species in which the male is isolated and displays conspicuously, and in which the female comes to him: among gallinaceous birds, the Ruffed Grouse (*Bonasa umbellus*), the Spruce Grouse (*Canachites canadensis*), and *Dendragapus*; among birds of paradise, *Diphyllodes magnificus* and probably other species; also probably most bower-birds (Ptilinorhynchidae) but too little is known of these to be certain. Steinfatt claims that the European Woodcock (*Scolopax rusticola*) comes in this category, but the evidence seems inadequate. In the species of this group it is not known if the female always returns to the same male.

(c) The Boat-tailed Grackle (*Cassidix mexicanus*), in which the females visit the flocks of males; this bird might almost be classed with the lek birds, but the males have no definite stations.

(d) The Cowbird (*Molothrus ater*) and European Cuckoo (*Cuculus canorus*) at times, but both these sometimes seem to form a more definite attachment.

2. *Sexes having a bond for a few days at time of copulation.*—In North American hummingbirds the male and female seem to remain together for a few days, but the male does not take any part in nesting activities and is then, perhaps, driven away by the female. Whether he takes a new female is not known. In the Wagler Oropendola (*Zarhynchus wagleri*) the members of the pair are also associated for only a few days, this ceasing at incubation. This also applies to the Penduline Tit (*Remiz pendulinus*) and to the weaver *Ploceus philippinus*, in which, unlike *Zarhynchus*, it is the male which builds the nest; once the female is incubating, the male *P. philippinus* builds a new nest and acquires another female; this sometimes occurs in *R. pendulinus*. It also occurs in the bishop-birds *Euplectes hordeacea* and *E. nigroventris*, but here, although the male takes no part in the rearing of the brood, the females nest in his territory, and he usually gives calls when they enter or leave, hence the bond is rather more lasting.

Among wading birds, the female Red-necked Phalarope (*Phalaropus lobatus*) leaves the male at the beginning of incubation, as do the tinamous (*Calopezus elegans*; *Crypturus*) and button quails (*Turnix*). At least at times, male and female Cowbirds (*Molothrus ater*) and European Cuckoos (*Cuculus canorus*) form temporary attachments.

3. *Ducks.*—Among many species of ducks the male normally leaves the female soon after she has laid, but the situation differs from that in the species mentioned in group 2 in that pair-formation often occurs in late autumn, winter or early spring, so that members of a pair remain together for several weeks before laying. Occasionally a male Mallard (*Anas platyrhynchos*) remains with the nesting female and attends the ducklings, and this also happens occasionally in other species. Thus there is gradation into the next group.

4. *Sexes remaining together for raising of the brood or for the breeding season.*—In this category fall the great majority of passerine and near-passerine birds, together with herons, nearly all wading birds, most of the different groups of sea birds, the birds of prey if they do not pair for life, and many other groups too numerous to list completely. Of special interest is the fact that a few gallinaceous birds are included, such as Bob-white (*Colinus virginianus*) and the American quail of the genus *Lophortyx*, and also a few birds of paradise, such as *Manucodia ater*, *Macgregoria pulchra*, and *Phonygammus*.

As regards the length of the pairing bond, most migrant passerine species, as for example New World warblers, pair up only shortly before nesting. But many resident species pair up several weeks or even months before nesting. The British Robin (*Erithacus rubecula*) pairs in mid-December but nests about the end of March; the

Loggerhead Shrike (*Lanius ludovicanus*) pairs up from November onward, and the Jackdaw (*Coloeus monedula*) forms pairs in the autumn. Regarding the other end of the breeding cycle, in species which have more than one brood, some normally retain the same mate for a second brood, although changing exceptionally, while in others, like the House Wren (*Troglodytes aëdon*), the mate is regularly changed between broods. The data on this last point are too well known to need specification; Tinbergen (1939, pp. 45-46) gives a valuable summary.

5. *Birds which pair for life.*—It seems to be commonly believed that most large birds pair for life, but positive evidence is extremely scanty. Three errors must be avoided. First, migrant species of loons and grebes have been said to pair for life because they arrive on the breeding grounds already paired, but they may well have paired in their winter quarters. Second, observations on captives are not reliable, since the birds are kept unusually close together. Third, cases of re-mating must be distinguished from true life-pairing where the pair remain together all the time. Thus, White Storks (*Ciconia ciconia*) frequently re-mate, but since the males usually arrive before the females, Schüz considers re-mating due to a tendency for the birds to return to the nest used in the previous year. In the British Robin, re-mating has been observed a number of times when it was certain that the sexes separated in autumn. Other instances where passerine birds have re-mated in a second year will not be summarized here except in cases when there is evidence that they remained paired outside the breeding season.

Among passerine birds, the most convincing evidence for life-pairing is in the Wrentit (*Chamaea fasciata*), where the pair keep their territory for life. Pairs of Cardinals (*Richmondena cardinalis*) and California Thrashers (*Toxostoma redivivum*) will remain at least loosely associated in winter and so may be said to pair for life. The Marsh Tit (*Parus palustris*) stays in pairs, which wander in winter, and the same is stated to be true for the Willow Tit (*P. atricapillus*), Crested Tit (*P. cristatus*) and at times the Blue Tit (*P. caeruleus*), although I have not read of certain evidence for these latter species. Pairs of Great Tits (*P. major*) have bred together five years in succession, which certainly suggests that they remained together outside the breeding season, although this was not investigated. Other passerine species suspected of life-pairing are Crested Lark (*Galerida cristata*), European Nuthatch (*Sitta europaea*), White-breasted Nuthatch (*S. carolinensis*), Brown Creeper (*Certhia familiaris*), Black Redstart (*Phoenicurus gibraltariensis*) and Stonechat (*Saxicola torquata*), although the evidence is not complete, so far as I know. The cowbird *Molothrus rufo-axillaris* sometimes occurs in pairs throughout the year. Exceptionally, pairs of British Robins and of Mockingbirds (*Mimus polyglottos*) have shared a territory in autumn and bred together next spring, but normally the members of the pairs separate. Corvids are commonly supposed to pair for life. They are frequently seen in pairs at any season, but this alone is insufficient evidence, for Lorenz found that his Jackdaws (*Coloeus monedula*) changed mates at times. A pair of Carrion Crows (*Corvus corone*) certainly nested together for ten successive years, which indicates that life pairing occurs at times in this family. Of course even if the corvids change mates occasionally, their habit of associating in pairs at any season (which also seems true of Magpies, *Pica pica*, and of various kinds of jays) puts them in a different class from species in which the sexes have no pairing relation outside the breeding season.

Pairs of Great Spotted Woodpeckers (*Dryobates major*) are thought by Steinfatt to remain together, but by Tracy to separate, after the breeding season. In captivity, parrots (Psittacidae) pair for life, and since Tavistock found this true of platycercine

parrots under semi-wild conditions, this may well be true in the wild. I have found no reliable evidence that any falconiforms or owls pair for life in spite of repeated statements that they do so; this should not be taken to mean they do not pair for life. Swans (*Cygnus*) and geese (*Anser*) pair for life in captivity, as does the Mute Swan (*C. olor*) under semi-wild conditions, and the general opinion is that this is true of wild birds.

Mr. H. Eliot Howard informs me that the Moorhens (*Gallinula chloropus*) on his pond have remained permanently paired except when an accident has befallen one of them. In amplification of his published papers on the Little Grebe (*Podiceps ruficollis*), Mr. P. H. T. Hartley writes that some of these birds remained permanently paired throughout the winters of 1932-33 and 1933-34. Birds breeding for the first time, and birds which have lost their mates, form pairs in February and early March; the reason that there was so much new pair-formation in the spring of 1935 was that the drought of 1934 had driven the birds from the inland pond where he observed. Mr. Hartley also adds that he has never seen sexual manifestations among the individuals forming winter flocks on the estuaries; so, unlike the individuals on the inland pond, those in the estuaries may not remain permanently paired.

It is thought that the barbet *Trachyphonus d'arnaudii*, the hornbill *Bycanistes cristatus*, and the Mallee Fowl (*Leipoa ocellata*) may pair for life, as pairs usually are seen together. Spur-wing Plovers (*Belonopterus chilensis*) are said to keep to the same mate and territory for life.

In gulls, the evidence is incomplete. Herring Gulls (*Larus argentatus*) have been recorded nesting together in four successive seasons, but whether they remained paired in winter is not known. Black-headed Gulls (*Larus ridibundus*) arrive paired at the gulleries (personal observation) and Miss M. Rothschild informs me that some of her abnormally crowded captive Black-headed Gulls retained a loose pairing in winter, and re-mated in spring, but this is not certain evidence for the wild state. Manx Shearwaters (*Puffinus puffinus*) and Wilson Petrels (*Oceanites oceanicus*) have re-mated in a second year, but there is no evidence as to whether these birds remain paired outside the breeding season. It is evident that far more data are needed on this subject.

Shortly after completing the manuscript for this paper, I read the interesting account by Skutch (1940), who states that in various tropical American passerine birds members of pairs remain associated outside the breeding season, keeping in touch with each other by special calls or song. This is common in wrens, including *Pheugopedius hyperythrus* and *Thryophilus modestus*, and also occurs in the Northern Tody Flycatcher (*Todirostrum cinereum*), the Tyrannine Antbird (*Cercomacra tyrannina*), the Buff-throated Saltator (*Saltator intermedius*) and the Prevost Cacique (*Amblycercus holosericus*).

MANNER OF MEETING OF THE SEXES

With regard to the way in which the sexes meet, birds may be divided into two main categories, those in which one sex maintains a territory with conspicuous display, and those which form into pairs while in flocks.

Birds with one sex isolated.—The isolated displaying sex is normally the male, but in a few species, as for example the tinamous (*Crypturus*) and Red-necked Phalarope (*Phalaropus lobatus*), it is the female. The size and nature of the territory varies considerably, as discussed later. Birds in this group with large territories (in some cases later used for feeding, in others not) include the great majority of passerine and near-passerine groups, which are far too numerous and well known to need specific mention, also some birds of prey, of which the Peregrine Falcon (*Falco peregrinus*) has been

studied best, the Bittern (*Botaurus stellaris*), and some gallinaceous birds (*Bonasa umbellus, Canachites canadensis,* and *Dendragapus*). Among the wading birds there are the Little Ringed Plover (*Charadrius dubius*), Red-necked Phalarope (*Phalaropus lobatus*), Woodcock (*Scolopax rusticola*), some individual Lapwings (*Vanellus vanellus*), Oyster-catcher (*Haematopus ostralegus*), Golden Plover (*Pluvialis apricaria*), and Redshank (*Tringa totanus*). Also there are some individual Great Crested Grebes (*Podiceps cristatus*) and at least some individual Moorhens (*Gallinula chloropus*).

This group includes in addition a large number of colonial nesting birds with extremely small territories, such as herons (*Ardea cinerea* and *Nycticorax nycticorax*), and many sea birds (cormorants, gannets, frigates, and some penguins). In some of these birds, especially the frigates and certain cormorants, the visual and vocal display is just as spectacular as that of any territorial passerine species. Colonial passerine species with isolated males include the Tricolored Red-winged Blackbird (*Agelaius tricolor*) and the Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*) among the Icteridae, *Ploceus philippinus* and presumably other colonial weaver-finches, and probably colonial-breeding swallows. The gap between the extremely colonial species and those with large territories is fairly marked, but is bridged by such species as the bishop-bird *Euplectes nigroventris,* the Barn Swallow (*Hirundo erythrogaster*) and the Starling (*Sturnus vulgaris*), which breed in groups but in which the males are rather too far apart to be described as colonial.

A third group of birds with isolated males are the lek species, already listed. It is possible that individual *Phaethornis* exchange song perches at their meeting grounds, but in *Manacus vitellinus* and *Lyrurus tetrix* each male has a fixed territory.

Birds which form pairs when in flocks.—This category includes many fringillid genera, notably *Coccothraustes, Loxia, Spinus, Leucosticte, Carduelis,* etc. Other passerine species include the Bush-tit (*Psaltriparus minimus*) and perhaps other tits, the waxwings (*Bombycilla*), the Brewer Blackbird (*Euphagus cyanocephalus*), Bay-winged Cowbird (*Agelaioides badius*), and perhaps the Fieldfare (*Turdus pilaris*) and Redwing (*Turdus musicus*). Also included are many migratory wading birds, such as Willet (*Catoptrophorus semipalmatus*), Avocet (*Recurvirostra avosetta*), Wilson Phalarope (*Steganopus tricolor*) (personal observation with J. T. Emlen of a migrating flock in pairs) and some individual Oyster-catchers (*Haematopus ostralegus*), Lapwing (*Vanellus vanellus*), Golden Plover (*Pluvialis apricaria*), and Redshank (*Tringa totanus*); all terns (*Sterna*) and gulls (*Larus*) so far studied fall in this category as do some grebes (*Colymbus*), loons (*Gavia*), all the ducks (Anatidae), platycercine parrots, some gallinaceous birds such as the European Partridge (*Perdix perdix*), the American quails of the genera *Lophortyx* and *Colinus* and probably the pigeons and doves.

For completeness, some rather special cases already described elsewhere must be mentioned under those where the sexes pair in flocks, namely, the Boat-tailed Grackle (*Cassidix mexicanus*), the Cowbird (*Molothrus ater*), the Wagler Oropendola (*Zarhynchus wagleri*) and Smooth-billed Ani (*Crotophaga ani*).

Whereas pair-formation has been studied in detail in a number of species where the male is isolated, no similar investigation has been made of how pair-formation occurs in a flock. This is one of the biggest gaps in the subject under review.

Variation in manner of pair-formation.—Often the members of a family of birds all show the same general type of pair formation, but in a few groups there is a remarkable diversity. Thus the birds of paradise and the gallinaceous birds both include (1) lek species, (2) birds with isolated males and sexes meeting solely for copulation, and (3) birds which pair for the breeding season; Stoddard suspects that some Bob-

white (*Colinus virginianus*) may remain paired during the winter. Again, the Icteridae include (1) species with isolated males holding large territories in which most of the food is later obtained, such as the Western Meadowlark (*Sturnella neglecta*) and probably the North American orioles (*Icterus*); (2) birds with isolated but smaller territories which are not feeding areas, such as the Red-winged Blackbird (*Agelaius phoeniceus*); (3) colonial species with isolated males, such as the Tricolored Red-wing (*Agelaius tricolor*) which nests in large colonies, and the Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*) which nests in small colonies; (4) birds which form pairs when in flocks, such as the Brewer Blackbird (*Euphagus cyanocephalus*) which nests in groups and the Bay-winged Cowbird (*Agelaioides badius*) which nests solitarily; (5) birds which form only a very temporary pair-bond, such as the Wagler Oropendola (*Zarhynchus wagleri*); (6) birds which meet solely for copulation, like the Boat-tailed Grackle (*Cassidix mexicanus*); and finally (7), the cowbirds (*Molothrus* and a few other genera), some of which are parasitic, some not, and which present very diverse habits. The Icteridae would well repay a detailed behavior study, such as Friedmann has already made for the cowbirds. A similar, but perhaps not quite so diverse, series could be traced in the Ploceidae, which include extremely colonial species, moderately isolated polygamous territorial males, strictly monogamous forms, and parasitic species; but the Ploceidae have been comparatively little studied.

In some birds there is variation even between individuals of the same species. Thus, from the summaries in the "Handbook of British Birds" and other sources, it appears that some individual Oyster-catchers (*Haematopus ostralegus*), Lapwing (*Vanellus vanellus*), Golden Plover (*Pluvialis apricaria*) and Redshank (*Tringa totanus*) have paired up when in the flocks, in some cases before reaching the breeding grounds (have some of these remained paired during the winter?), whereas other individual males arrive at the breeding grounds unpaired and claim isolated territories. Further study of these species is needed. In the Great Crested Grebe (*Podiceps cristatus*) some individuals arrive on the breeding grounds paired and in other cases the unmated males take up territories. In the British Robin (*Erithacus rubecula*) and Mockingbird (*Mimus polyglottos*) another type of individual variation occurs; usually the members of a pair separate and hold isolated territories in the autumn, but occasionally they remain together.

Territory.—I do not propose to include a full discussion of the functions of territory. (For my more recent views, see papers of 1937, 1939.) It may be pointed out that a territory in which an isolated male displays and obtains a mate takes four main forms: (1) in a lek bird it has no function except in courtship; (2) in colonial birds, such as frigates, the nest is later placed there; (3) in birds such as some waders the territory is fairly large but food is obtained outside it; (4) in some passerine species most or all of the food is obtained within the territory. But these four do not exhaust the categories of territorial birds. (5) Many of those species which pair up when in flocks later defend territories around their nests (wading birds, gulls, terns, grebes, loons, *Lophortyx*, probably some of the fringillid genera cited, and possibly some ducks). The two main functions which have been ascribed to territory are pair-formation and food; but all these species pair up before taking up their territories, and many of them feed exclusively or mainly outside their territories. Hence, the significance of their territory remains unknown; possibly it originates through defense of the mate against rivals, but in many instances a definite, limited area is acquired and defended. Further study of this group is needed. (6) Autumn territories, found in the British Robin, Mockingbird and Loggerhead Shrike (*Lanius ludovicianus*) are discussed elsewhere

(Lack, 1939). (7) The territory defended by each female Cuckoo (*Cuculus canorus*) is a laying area, and does not necessarily have the same boundaries as the territory defended by the male. (8) Smooth-billed Anis (*Crotophaga ani*) defend a group territory.

Polygamy, polyandry and promiscuity.—Mayr (1939) has recently summarized the data on irregular sex relations in birds, and discusses polygamy and polyandry. Occasional cases of bigamy in normally monogamous species are now known from many species, and need not be detailed; Tinbergen (1939, p. 43) gives a good summary. Regular polygyny occurs in the Bittern (*Botaurus stellaris*), Corn Bunting (*Emberiza calandra*), several species of bishop-birds, of which *Euplectes hordeacea* and *E. nigroventris* have been best studied, in *Ploceus philippinus* and doubtless other ploceids, in the Red-winged Blackbird (*Agelaius phoeniceus*), the Tricolored Red-wing (*A. tricolor*), the Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*) and the Wagler Oropendola (*Zarhynchus wagleri*). In all these species except the last the male is territorial (though the size of territory varies considerably), and the females nest in the territory of the male. Other species for which regular polygyny has been claimed are Penduline Tit (*Remiz pendulinus*), Muscovy Duck (*Cairina moschata*), Ostrich (*Struthio camelus*), Great Bustard (*Otis tarda*), Wild Turkey (*Meleagris gallopavo*) and Rose-colored Pastor (*Pastor roseus*). The last has also been claimed to be polyandrous, and is therefore more probably promiscuous, but both this species and the others require further study, as do a number of species for which only rather vague evidence has been produced.

Regular polyandry is rarer than polygyny, but occurs in tinamous (*Crypturus*), button quails (*Turnix*) and the painted snipe (*Rostratula*), in all of which the female is the conspicuous displaying sex. In phalaropes the female displays, but regular polyandry has not been proved, although it is suspected by some workers (see Tinbergen, 1939).

In the above-listed polygynous species that have been adequately studied, there is a definite, though in some cases very temporary, bond between the two sexes; in some the male is occupied with only one female at a time, in others it retains contact with all its mates. The other main group of birds, popularly supposed to be polygamous, are the lek species, already listed, together with those other gallinaceous birds which have no regular pairing bond. But in these one should not speak of "polygamy" at all, since no true pair-bond is formed; promiscuity is the correct term.

There is great ignorance as to the sex ratio in species that are promiscuous. Thus, in the Blackcock (*Lyrurus tetrix*) some workers have claimed that the lek habit results from a surplus of males, others from a surplus of females; the actual sex ratio is unknown and may well be equal. In the Ruff (*Philomachus pugnax*) Selous proved that one male copulated with several females. He could not be certain that one female was mounted by more than one male, but thought this occurred and it seems probable since individual females will visit more than one lek. For the other species, the male apparently copulates with several females, but it is unknown whether the female always returns to the same male or not.

The Boat-tailed Grackle (*Cassidix mexicanus*) seems to be promiscuous and this is more probably the situation than polygyny or polyandry in the Rose-colored Pastor (*Pastor roseus*). Promiscuity holds at times for the parasitic Cowbird (*Molothrus ater*) and Cuckoo (*Cuculus canorus*), in the latter apparently because the female's territory is not coextensive with that of a male, and further some females do not have territories. Exceptionally, promiscuity occurs in many other species, for the paired males of nor-

mally monogamous species will occasionally copulate with a strange female, as observed by Howard in the Moorhen (*Gallinula chloropus*). Portielje (1938) summarizes other cases, which need not be detailed here.

An exception to the normal avian condition of monogamy takes a different form in the timeliine bird *Yuhina brunneiceps*. Groups of individuals of both sexes build a nest, in which several females lay, and both sexes help to raise the brood. Skutch (1935) summarizes numerous instances where odd individuals of various species attach themselves to a mated pair and help them to raise the brood. These examples help one to understand how the curious condition in *Yuhina* may have been evolved, in which there cannot be said to be pair formation at all. The same quite possibly applies to the California Woodpecker (*Balanosphyra formicivora*) and to a few other species. Group nesting also occurs in the Smooth-billed Ani (*Crotophaga ani*) and here there seems to be strict monogamy at times, polygyny or polyandry at others.

SEX RECOGNITION

Earlier work.—In recent years the manner of sex recognition and the detailed behavior at pair-formation have received considerable attention even though relatively few species have been studied in any detail. Craig (1909) and Whitman (1919) conclude that doves do not know the sex of a strange individual until they are at close quarters, when behavior differences occur. Allen (1934), working on the Ruffed Grouse (*Bonasa umbellus*) concluded that, in general, birds have no recognition of the sex of another bird, but that, in pair-formation, the dominant individual takes the male role, the subordinate bird the female role, irrespective of sex; normally, but not invariably, the male is dominant to the female. Independently, Hingston (1933) expressed rather similar views, more crudely and more generally applied. From experiments with mounted birds, Noble and Vogt (1935) discovered that in many species with pronounced sexual dimorphism the male can distinguish the female by plumage.

Lorenz' views.—Lorenz (1935) classifies pair-formation into three main types. In the first (lizard) type, the male pursues all others of its species; a strange male fights, but weak males and females are pursued and copulated with. This type, rare in birds, occurs in the Muscovy Duck (*Cairina moschata*). The second (labyrinth-fish) type is the commonest in birds, and includes the Ruffed Grouse. Lorenz accepts Allen's conclusions provided they are restricted to this group. Each sex possesses the potentialities of both sexes; an individual tends to react as a male unless subdued by the fighting or dominance display of another individual. For the formation of the pair, male dominance is essential. Homosexual pairs can occur. Specifically included in this category are various gallinaceous birds, ducks, pigeons, and the Jackdaw. In the third (cichlid-fish) type, there is display by both sexes and no dominance order. The birds are not sexually ambivalent, for, if they were, each would have to act as a male. The female is not made inferior; examples: herons, stork, swans, geese, Great Crested Grebe.

Lorenz put forward his classification tentatively and as a basis for further work. He does not claim that his categories are exhaustive, and he allows for great variation within each. Nevertheless, I find it impossible to use them, even as a basis for a revised classification. First, his system involves placing such birds as *Bonasa*, which do not form true pairs at all because the sexes meet simply for copulation, with types like the corvids which pair for the breeding season and perhaps longer. Second, as is clear from Heinroth (1911) and Phillips (1922), Muscovy Ducks do sometimes differentiate females ready to mate from other individuals, and the female at times waits for the male instead of fleeing. Hence this species must be placed in the second category. Indeed no species of bird seems to fall in Lorenz' first category. Then, Lorenz' second and

third categories do not represent definable divisions of behavior. Females of at least most species in the second group show some display, so might be classed in the third, mutual display, category. Also, the Night Heron (*Nycticorax nycticorax*), put by Lorenz in the third category, would, from Noble, Wurm and Schmidt's work (1938), be placed in the second category, since it shows dominance reactions, and homosexual pairs may be formed; but it also has mutual courtship. Again, Allen (1934) for the Canada Goose (*Branta canadensis*), and others for the Mute Swan (*Cygnus olor*), have recorded homosexual pairs, although both species are placed in the third category.

Tinbergen (1939) points out that Lorenz' description of each main type includes a number of criteria of a different order, which cannot well be combined. Nevertheless, Lorenz relies mainly on one character, that is, the method of sex recognition, on which basis Tinbergen redefines the three groups as follows: (1) where only the male has releasers, hence, non-displaying males are treated like females; (2) where releasers are present in the female so that all individuals that do not show the female releasers are attacked (treated like the male); (3) where releasers are present in both sexes. Tinbergen considers that (1) the lizard type and (2) the labyrinth fish type are really the extremes in a series, perhaps not occurring in perfect form in any birds. All birds are therefore in the third, cichlid, group, in which both sexes possess releasers, but when those of one or the other sex are poorly developed they approach one or the other extreme. This seems very sound.

In conclusion, it should be pointed out that Lorenz ought not to be criticised too much, since his was the first constructive attempt to classify and coordinate our knowledge of an extremely complex subject; his paper has had a decidedly stimulating effect on many workers, including the writer. Further, the criticisms here offered are partly the result of facts which were not known when Lorenz wrote his paper.

Dominance.—The term dominance was first used in birds in the social hierarchy experiments of Schelderuppe-Ebbe (1935). But the meaning of dominance is quite different in the statement that the male dominates the female in pair-formation or copulation, as pointed out by Noble (1939). He rightly distinguishes between the former type of social dominance and the latter type of sexual dominance. Further, evidence for this distinction is found in Nice's observations. The male Song Sparrow (*Melospiza melodia*) courts the female by "pouncing." Nice (1938) writes: "The object of pouncing is domination"; and again (1939): "Although he dominated her by his pouncing, yet in many little everyday encounters, she dominated him." Nice evidently supposes that in the sexual sense the male dominates the female (as the theory requires), but in the social sense it seems as if the female is dominant to the male. Shoemaker (1939) finds that, in the canary (*Serinus canarius*), whereas males normally dominate (social sense) females, in the mated pair the female dominates (social sense) her mate, which would be contrary to theory if social and sexual dominance were the same.

But even when this distinction has been made, there are considerable difficulties, since dominance has been used in a vague and partly subjective sense. For example, it has been stated that "dominance and fear are the important principles . . . in controlling the mating cycle" (Allen, *loc. cit.*), and that "the object of pouncing is domination" (Nice, *loc. cit.*). Working on Night Herons (*Nycticorax nycticorax*), Noble (*loc. cit.*) is much more explicit, and at times simply means by dominance the relative positions of male and female, in particular, which has its head and neck higher. But he also states that at the beginning of pair-formation the male is in a subordinate position and his display "gradually restores his dominance." Noble refers to what is obviously an important relation between the pair, but it is extremely difficult for those who have not worked with similar species to know just what is meant.

The dominance theory was put forward partly to explain sexual ambivalence, whereby in homosexual pairs of birds one member may go through all the actions typical of the opposite sex. Since I have recently discussed sexual ambivalence elsewhere (Lack, 1940), I will only state that this behavior is extremely complex, and probably has a different basis in different cases, sometimes genetic, sometimes hormonal, and sometimes due to various types of external situation.

The dominance theory postulates that at pair-formation the male in some sense impresses or overpowers the female, sometimes through aggressive display. To prevent a possible misinterpretation, I should state that the aggressive behavior shown by English Robins at pair-formation (Lack, 1939) is not related to dominance in any way; it is sporadic, soon dies away and probably results from the maladjustment of the formerly isolated individuals to the new situation in which a second individual is tolerated. Verwey (1929) has a similar suggestion for parallel behavior in the Common Heron (*Ardea cinerea*).

To conclude, I would not deny the importance of sexual dominance, but it needs clearer definition, and it is not nearly so widespread in birds as Allen (1934) implies. I cannot say more since I have not studied at first hand any species in which it occurs.

First and later reactions.—Tinbergen (1935, 1939) working on sex discrimination in the Red-necked Phalarope (*Phalaropus lobatus*) and the Snow Bunting (*Plectrophenax nivalis*) stresses the difference between a first reaction released by a very general external situation, and later reactions with more particular releasers. Judged on its first reaction to a bird at a distance, a male Snow Bunting apparently cannot distinguish the two sexes, but its behavior when at closer quarters shows that it does so readily. Further, the simplicity of the releaser for the first reaction is not due to inadequate visual powers.

In general, Tinbergen (1939) thinks that (1) species with marked sexual dimorphism, such as some of those used in the experiments of Noble and Vogt (1935), may discriminate the sexes at the first reaction; (2) other species, like the Snow Bunting and the Red-necked Phalarope, do not do so at the first reaction but do so without difficulty at close quarters; and finally (3) species like the Common Tern (*Sterna hirundo*) and Ruffed Grouse have a much longer undifferentiated reaction of the sexes, since both sexes behave in the same way for a comparatively long time after first meeting. This general classification seems sound. Male Blackcock (*Lyrurus tetrix*) obviously recognize females at once; this was corroborated by experiments with mounted birds. I have not studied carefully any species like the Snow Bunting or the Red-necked Phalarope. The British Robin (*Erithacus rubecula*) has a long period of identical reaction of the sexes, so comes in the third group.

Observations on captives.—In the wild, each male Ruffed Grouse is isolated. Drumming, by which means the female normally locates the male, was, according to Allen (*loc. cit.*) greatly reduced in captivity. Consequently, Allen's conclusions on sex recognition do not necessarily apply to wild birds, which, I should guess, discriminate each other's sex much more readily. I would therefore not include the Ruffed Grouse in Tinbergen's third category without further evidence. In general, pair-formation, particularly when isolated territorial males are involved, is likely to be highly abnormal in captivity. This also is indicated by the much greater frequency of hybridization in captivity between species than occurs in the wild.

Sex recognition at the time of pair-formation.—I agree with Tinbergen (1939) that the terms "sex recognition" and "sex Kumpan" imply entities which do not exist. Lorenz (1935) has shown that for different phases of its behavior a bird's "recognition"

of its own species is related to very different external signs or releasers; what releases one reaction does not necessarily serve for another. The external situation leading to pair-formation is markedly different from that leading to copulation, and it is different again for other sexual reactions. In particular, the experiments with mounted birds refer to copulation, and do not necessarily have any bearing on pair-formation.

In the British Robin (Lack, 1939) one cannot speak of sex recognition at any stage of the breeding cycle. In pair-formation, the unmated male treats intruding males and mated females alike, but reacts differently to an unmated female. How he differentiates an unmated from a mated female is unknown, but since pair-formation takes some time, discrimination is evidently difficult. The robin is perhaps exceptional. In other small passerine species, for example the Song Sparrow, *Melospiza melodia* (Nice, 1938), the male reacts similarly to all strange females, whether mated or unmated, hence the problem here is genuinely one of sex discrimination, which in the Song Sparrow, where the sexes are alike in plumage, depends primarily on a special call of the female. In other species, for example the Chaffinch, *Fringilla coelebs* (Lack, MS), it depends on plumage differences. In such species, the male does not normally form a pair with an already mated intruding female because (1) the latter rarely leaves her territory, and usually retreats to it at once when chased, whereas an unmated female, though she may be chased out, keeps returning to the same territory; (2) in some species, like the Song Sparrows, the mated male defends his female; (3) in others, like the Chaffinch, the mated female drives out other females from the territory.

Clearly far more facts are needed on behavior at pair-formation. Some species discriminate the sexes readily, some have a generalized first reaction but discriminate at close quarters, in others some kind of dominance relation is perhaps involved. There are yet others in which the behavior does not seem to fit into any simple pattern. The pair comes together gradually and with difficulty. Brian Roberts informs me that at the beginning of the season Gentoo Penguins (*Pygoscelis papua*) of both sexes have similar behavior (females as well as males may defend stations), but gradually the birds sort themselves out. (His account supersedes that by Levick on *P. adeliae*, who claimed that the isolated sex was normally the female.) In Common Terns (*Sterna hirundo*) both sexes behave alike at the beginning of pair-formation, and the problem is simpler in British Robins and Common Herons only to the extent that the males maintain territories which the females visit. When a careful study has been made of those species which pair up in flocks, a similar complexity will probably be revealed in many cases; the members of a pair gradually come together, using many small interrelated mutual actions, with intervals when they move apart again. I think it will prove exceptional to find pair-formation depending on a simple dominance mechanism or set of releasers.

Before closing this section, mention may be made of the present confusion concerning pair-formation in cormorants and shags (*Phalacrocorax*), in which some writers affirm that the male is the isolated displaying sex, others the female, and some that either may do it. Observations refer to different species, but it is unlikely, though possible, that the different species differ in this respect. Possibly the situation is similar to that in *Pygoscelis* and *Sterna*, but more data are needed for accurately sexed birds.

Individual recognition of mate.—After the pair has formed, "sex recognition" is a quite different problem; it is that of distinguishing the mate individually from all others of her species. Such individual recognition of the mate from others, often at considerable distances, by sight and in some cases also by sound, has now been proved for many species. Only in moments of unusual stress will a territorial bird attack its own mate, then usually very temporarily; such attacks were recorded several times in British

Robins which had been paired for weeks or months. The differences involved in distinguishing an individual bird are normally too fine for the human observer to detect and indicate the accuracy of which bird vision is capable. Whitman and Craig working with doves, and Nice with the Song Sparrow, show that in addition to its own mate, the male distinguishes the sex of neighboring birds through individual recognition, acquired by previous experience.

Sex recognition at copulation.—The external situation provided by the female leading up to copulation is different again, and the releasers are evidently much simpler than those involved in pair-formation. The major stimulus in most species is simply that the female keeps still. In some species (British Robin and Moorhen) the head is somewhat lowered, in other species (many fringillids and the Tricolored Red-wing, *Agelaius tricolor*) the beak is pointed upward. Again, in some species the tail is somewhat depressed or spread, and in some the wings may be slightly drooped. That the position of head, tail and wings are subsidiary is illustrated by the frequency with which a male bird will copulate with a mounted bird, in which the only feature of the inviting female provided is its stillness. (See Noble and Vogt, and many recent behavior studies.) In a few species (Song Sparrow, Nice, *loc. cit.*, and the flicker *Colaptes auratus*, Noble, 1936), the female also gives a special call. Noble thinks this is why, unlike most birds, a male flicker does not copulate with a female mount.

One must not argue too much from experiments with mounted birds. Because a male mounts an object, it is not safe to deduce that the male fails to distinguish this object from a living female of its own species. The point is illustrated by human sex perversions and by the record, quoted by Dobzhansky (1937), that a horse copulated with a stuffed cow. Probably the plumage and structural characters which differentiate related species of birds or the two sexes, and which are undoubtedly of importance in pair-formation, do not form an essential part of the external situation releasing copulatory behavior in the male bird. In nature, a strange species or a male of the same species would normally not assume the posture releasing copulation in the male. When Noble and Vogt (1935) find that a male House Wren (*Troglodytes aëdon*) will copulate with the mount of a Winter Wren (*Nannus hiemalis*), it does not, of course, follow that a House Wren cannot distinguish a live Winter Wren from its own species at the essential time of pair-formation. The same workers' experiments with various sexually dimorphic species are of great interest because they show that, although, through being motionless, a male mount provides the main (but probably not the sole) factor in the external situation releasing copulation, nevertheless the males of sexually dimorphic species did not copulate with mounted males; the male plumage counteracted the other influence. Experiments with the Galapagos finch *Geospiza fuliginosa* (Lack, MS), in which the males are black and the females gray-brown, showed that breeding males would sometimes copulate with black male mounts. But, it is shown that they can discriminate the sexes by plumage differences because courtship directed toward a male mount occurred in fewer individuals, and here tended to be less intense, than courtship of a female mount. All one can say is that in *Geospiza fuliginosa* the male plumage had a less inhibitory influence over the reaction to motionlessness of the mount than in the sexually dimorphic species investigated by Noble and Vogt.

In elicting copulation, the internal state of the male is extremely important. At the appropriate stage of the breeding cycle, the internal factors leading to his mounting the female are normally of such strength that copulatory behavior is released whenever the female assumes a particular attitude, but not otherwise (except when experimentally imitated). But, if the male's internal state is unusually strong, other external situa-

tions, normally inadequate, may release mounting; if unusually weak, the normal external situation may be inadequate; sometimes the female then assumes an exaggerated posture, which may or may not lead to the male being able to mount. (See Lack, 1939.)

That personal recognition of the mate is not a main factor in releasing copulatory behavior is shown by the mated males of many species which have copulated with mounted specimens, and is particularly well shown by a British Robin which copulated four times with a mount while its own female stood beside it posturing at the specimen. The latter situation is particularly striking since a male robin normally attacks at once any strange robin in its territory (the mate being recognized individually). In this experiment, the mount provides the external situations for two reactions: (1) motionlessness, releasing copulation; and (2) a strange robin, releasing attack. Since most male robins attack a mount, the second is usually predominant. In nature, of course, it does not normally happen that a strange individual provides the releaser for copulation, but Howard has observed this in a Moorhen, whereupon the previously aggressive male copulated.

SEXUAL SELECTION

Under sexual selection, Darwin discussed the female's selection of a mate and the secondary sexual characters which have been evolved by this means. Modern discussions usually include all secondary sexual differentiation, though much of it is not thought to have evolved through the female's selection of her mate in the narrower sense in which Darwin conceived it. Secondary sexual differentiation is associated with four distinct types of display in birds: (1) antaposematic display (Huxley, 1938), that is, threat display between rivals, especially rival males; (2) gamosematic display, or display which assists the pair to find each other; (3) epigamic display, or display between the sexes to promote copulation; and (4) post-nuptial display, or display between the sexes after copulation.

The first three types of display, antaposematic, gamosematic and epigamic, have all doubtless contributed to the evolution of brightly colored areas in male, and less commonly, female, birds, since one can find species in which a colored area is used exclusively in one or the other of these types of display. Gamosematic display involves sexual selection in the narrower Darwinian sense, since gamosematic characters are those which influence the female in selection of a mate at pair-formation. Antaposematic display can also be included in the Darwinian meaning, since such threat display results in the male's acquisition of a mate, even when the immediate object of such fighting is the acquisition and maintenance of a territory. But epigamic display is in a different category, since in monogamous territorial birds the female normally has no chance of seeing the epigamic display of any male except her mate, and the latter may have been selected some weeks or months earlier. There is direct evidence that epigamic display stimulates ovulation (Craig, 1911; Matthews, 1939) and indirect evidence (see especially Howard, 1929) that it helps to synchronize the two sexes in copulation, since most such display occurs when the other sex fails to respond adequately. Hence epigamic display and associated color patterns have survival value, though not at all on the same grounds as those postulated by Darwin. While epigamic display is often individual, Darling (1938) shows the influence of the group on its effectiveness, and I have shown that there may also be group selection of gamosematic display in lek species like the Blackcock (*Lyrurus tetrix*).

Postnuptial display sometimes takes the same form as epigamic display, as in the Great Crested Grebe (*Podiceps cristatus*), and sometimes that of the male feeding the female (Lack, 1940). It is commoner in birds than usually realized, and apparently

serves to maintain the bond between the pair (Huxley, 1914; Lack, 1939). I know of no instance where any structure or colored area is used exclusively in postnuptial display, so that the latter has probably played no part in the evolution of such structures.

The only experimental investigation of sexual selection in birds is that on Budgerigars (*Melopsittacus undulatus*) by Cinat-Tomson (1928), who found that the females preferred the males with the larger number of throat spots. Before accepting this result it is essential to know how pair-formation is effected in wild Budgerigars (the method adopted in the experiments seemed highly artificial), and what types of display utilize the throat spots. This is not to deny the value of the experiment, especially since Noble (1938) has demonstrated similar sexual selection in fish.

It has often been assumed that sexual selection is unaffected by other species. But I have found that male secondary sexual plumage is commonly lost in land birds of oceanic islands. In such species, threat, pair-formation and epigamic display are presumably just as important as on the mainland. Nevertheless there is a further function for such plumage, namely, to enable the female to recognize and pair up with a male of her own, as distinct from some other, species, since hybridization is at a selective disadvantage. The few land birds which have colonized oceanic islands are normally removed from all related species which the female might confuse with her own, hence this function disappears. The opposite of this process is seen in such birds as the pheasants (Phasianidae) and some other gallinaceous birds (*Tetrao* and *Lyrurus*), the birds of paradise (Paradiseidae), and the hummingbirds (Trochilidae) in which, correlated with the absence of a definite pairing bond, hybridization is relatively common, and in turn correlated with this, there is a maximum development of male secondary sexual differentiation, each species being strikingly distinct from the rest. Here, gamosematic characters must not only be striking, but similar throughout the species, and distinctive from all those of all other related species in the same region. The Ruff (*Philomachus pugnax*) would seem to be one of the few species in which the secondary sexual plumage varies considerably. Molony (1937) naively attributes this to variations in female taste, which seems unlikely. Two points may be noted: (1) although variable, the plumage of each Ruff is quite unlike that of any other species; (2) the birds display in a group, hence may, to some extent, be selected as a group, so that individual variation is less important.

SUMMARY

1. In some species of birds, the sexes meet solely for copulation, in some they form a very temporary pair-bond, in most they pair for the brood or the breeding season, in some they pair for life.

2. In many species the male is isolated in a territory, which varies greatly in extent in different species, and the female comes to him there. In a few, the female is the isolated displaying sex. In many other species, pair-formation occurs in the flocks.

3. Throughout some families of birds the type of pair-formation is similar, but considerable variation is found within the Icteridae, Paradiseidae and some other groups.

4. Some individual *Podiceps cristatus* and *Haematopus ostralegus* form pairs when in the flocks, others through isolated territorial males.

5. In some species the territory is used neither for pair-formation nor feeding.

6. The data on polygyny, polyandry and promiscuity are summarized.

7. One should not speak of "sex recognition," but of the external situations leading to pair-formation, copulation, etc., situations which are often different for different phases of sexual behavior.

8. Sex recognition is discussed, particularly the views of Lorenz, Noble and Tinbergen, and the phenomena of dominance, first and second reactions, and copulation

with mounted specimens. The data are too few for a comprehensive classification and analysis.

9. Sexual selection is associated with four distinct types of display, of which (1) antaposematic and (2) gamosematic come within the Darwinian definition, whereas (3) epigamic display does not. (4) Postnuptial display, though common, may not have had much influence on the evolution of structures. The loss of male secondary sexual plumage in species inhabiting oceanic islands is discussed.

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Totnes, South Devonshire, England, July 19, 1940.

THE MIDWINTER DISTRIBUTION OF THE CROW IN CALIFORNIA

WITH TWO ILLUSTRATIONS

By JOHN T. EMLEN, JR.

Crow distribution is a matter of both practical and scientific interest. Accordingly a survey of wintering crows in California was conducted during the years 1935-40, patterned after the New York State survey of 1932-33 (Emlen, 1938). Much information was obtained from the literature, from conversation and correspondence with field workers and from personal field observation. The main basis for the present report, however, is a state-wide survey conducted during the winter of 1937-38 with the cooperation of game wardens, county agricultural agents, farm advisers, high school instructors in vocational agriculture and many independent individuals. Each cooperator was presented with a questionnaire covering the midwinter (December-February) occurrence, distribution, flights, roosts, numbers and history of crows in his district. The response was generous: observations from over 1000 persons were incorporated in the 393 reports received; the 23 counties which contained more than a thousand wintering crows averaged 11.7 reports each. Grateful acknowledgment is hereby extended to members of the California Division of Fish and Game, the California State Department of Agriculture, the University of California Extension Service, the California Department of Education, and all independent observers who cooperated in supplying information.

Regardless of the experience and reliability of the observer, estimates of numbers in crow flocks are always susceptible to the "human factor," and no claims are made here for great accuracy in all figures presented. Areas from which seriously conflicting reports were received were rechecked by direct correspondence.

Summary of data.—The Western Crow (*Corvus brachyrhynchos hesperis*) ranges in suitable situations through western North America from central British Columbia, southern Saskatchewan and Montana, south to northern Lower California and central New Mexico. In winter, certain of the colder and more heavily forested parts of this range are evacuated in favor of lowland agricultural areas and river bottoms from southern British Columbia to the Mexican border. California, although it lies entirely within the boundaries of this winter range, supports a rather sparse population of crows which, in the 1937-38 survey, totaled about 82,000 individuals. These were distributed among 68 population units or centers with from 50 to 20,000 birds in each (fig. 79). Each unit had one or more roosting sites which the birds used habitually or with but slight local shifts, and from which they foraged during the day for distances of up to 25 miles.

Population densities on these wintering territories varied from about 5 to 25 crows per square mile. Comparable density figures for New York State territories in 1932-33, ranged from 20 to 79 per square mile (Emlen, *loc. cit.*). Taking the state as a whole, California held only .52 crows to the square mile whereas New York had 4.6 and Connecticut about 16.0 (R. P. Allen, MS).

Geographic analysis.—The wintering territories of the crow in California may, for purposes of analysis, be grouped into five geographic regions: north coast, central coast, south coast, the Sacramento Valley, and the San Joaquin Valley.

The northern coastal region, extending for 300 miles from San Francisco Bay to the Oregon boundary, is more or less mountainous, and generally well forested with coast redwood, Douglas fir, yellow pine and incense cedar. About 6700 crows in 16 population centers (27 known roosts) were reported along the narrow alluvial valleys

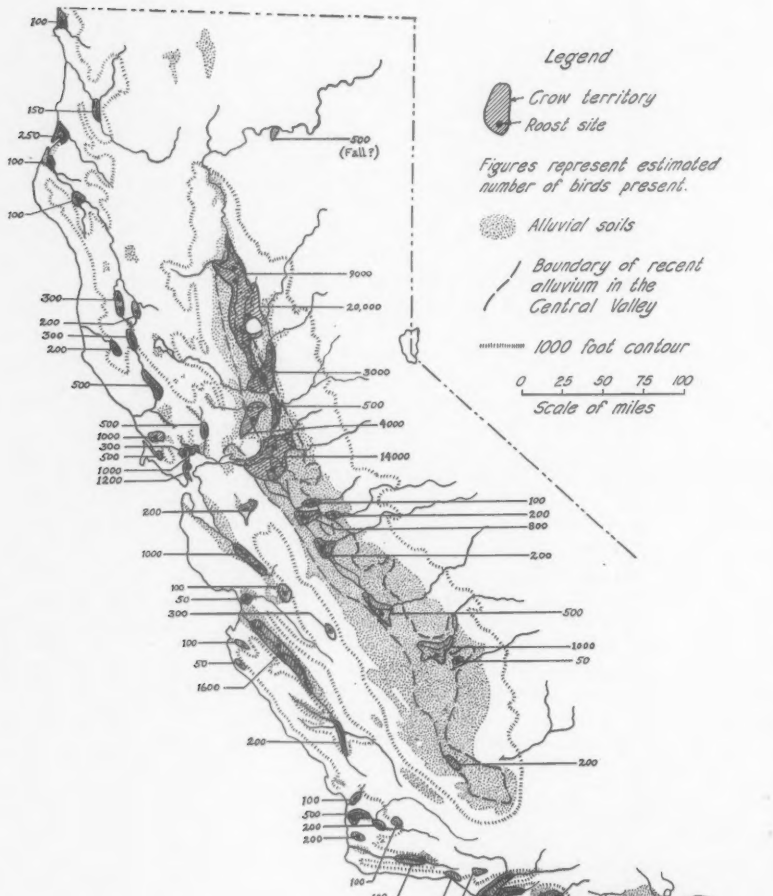

Fig. 79. Territories and populations of wintering crows in California, 1937-1938.

of coastal creeks and rivers. The heaviest concentrations were in Marin County at the southern end of the region (fig. 79).

The central portion of the coast, from San Francisco Bay to San Luis Obispo County, is 200 miles long. The terrain is hilly save for the Santa Clara and Salinas valleys. Total

annual precipitation is less than to the north, and the upland vegetation is largely chaparral (brush) and open oak groves. About 3600 crows were reported in 9 population centers (14 roosts) in this region. Three-fourths of these birds were located on the agricultural lands of the Salinas and upper Santa Clara valleys. Crows are absent from the northern part of this region which borders San Francisco Bay although they are quite numerous, as already pointed out, on the opposing Marin County shores just to the north.

The southern coastal strip of 300 miles, from southern San Luis Obispo County to the Mexican line, has a mountainous interior in which chaparral is the dominant vegetation type, and a coastal lowland, originally grass covered but now largely under cultivation. A total of 17,600 crows was reported from 27 population centers (44 known roosts) in this region, with the largest concentrations in the valleys of the Santa Clara, San Gabriel and Santa Ana rivers in Ventura and Los Angeles counties. The eight most southerly centers constituting the outposts of the winter range for the species, were all small, aggregating about 700 birds.

The Sacramento Valley is an almost uninterrupted lowland plain in the interior, 150 miles in length and 35 miles in width. Unlike the irregular and discontinuous habitat of the coast regions, the Valley provides a rather monotonous sweep of terrain, primitively in grass, now largely under cultivation. Crow flocks are larger there than elsewhere in California, and the roosting behavior is more like that to be seen in eastern and midwestern parts of the United States. About 50,000 crows, well over half of the State's total, were reported from 6 more or less confluent territories (8 roosts) in this region. One small group was reported to have remained in the Fall River Valley, Shasta County, at least into December.

The San Joaquin Valley is the southern portion of the great interior lowland. The natural vegetation does not differ markedly from that to the north, but there is less land under cultivation, precipitation is lighter, and surface water is inferior both in quantity and quality. The area is nearly half again as large as the Sacramento Valley, but only about 6 per cent as many crows were reported. These 3050 birds were found in 7 small population centers (8 roosts), mostly at the junctions of major rivers.

Historical record.—The locations and boundaries of winter crow territories in New York State in 1932 were essentially the same as those reported 25, 50, and, in one case, 125 years before (Emlen, *loc. cit.*). A similar permanency of range is indicated in the present California survey, although definite information in the literature is comparatively scarce. Of the 75 observers who commented on past conditions, 73 had noted a striking stability in local distribution winter after winter as far back as their recollections extended, which was from 5 to 50 years. Only two changes were reported: one roost near Long Beach, Los Angeles County, was abandoned about 1920 (Robertson, corresp.; also Robertson, 1931); another near Arlington, Riverside County, failed to form in 1937-38 (Gyger, corresp.). In both of these cases other roosts were situated within 12 to 15 miles so that the territorial changes were small. Thus, with the limited information in hand it appears that the midwinter range of the crow in California is essentially stable, and that the distribution as outlined in the present survey is typical of any winter season with but slight modification.

Statistics on crow numbers in the past are not available. In their absence we are obliged to refer to old-timers for comparative statements based on recollection. Such data are of dubious value in most instances, but collectively they may have some significance. Fluctuations from year to year were reported by a few of the 186 observers who commented on population changes, but most of the reports were concerned with comparisons of present and past (5 to 50 years ago) abundance. Of these, 67 reported

an increase, 27 a decrease, and 92 no change. A summary and evaluation of all these comments points to a general increase in the Sacramento Valley and the north coast region, particularly in Marin County, but little or no change in other parts of the State.

DISCUSSION

It is not possible to make a complete survey of the environmental factors which might influence the winter distribution of crows. A few of the more obvious items may, however, be considered in the light of information obtained in the present survey.

Climate.—Although climate probably plays a part in limiting the ultimate northward and southward dispersal of the crow as a species, it seems to have very little bearing on the location and conformation of the occupied range in California. The Lower Sonoran, Upper Sonoran and Transition life-zones, as mapped by Grinnell (1935), all contain crows in winter, yet in each of these the distribution is extremely patchy. It is barely possible that winter temperatures account for the absence of crows in the northeastern (average 25° F.) and southeastern (average 55° F.) corners of the state, but they cannot explain the irregular distribution elsewhere, for the species is quite eurythermic. There seems to be even less correlation with climatic factors other than temperature. Crows winter in places having a variety of atmospheric conditions, from the coastal areas of high humidity and precipitation to the arid plains of the San Joaquin Valley, and from the fog bound north coast where the sun shines for an average of only 4 hours per day in winter, to the valleys of San Diego County which at the same season receive 7.5 hours of sunshine per day (Kincer, 1928).

Altitude.—Of the 68 wintering territories in California, 60, including all of the larger ones, are situated below the 1000-foot contour. This restriction to low altitudes is probably a secondary relationship. Barometric pressure, *per se*, is not likely to be a factor (see Moreau, 1934, p. 53) and definitely cannot explain the irregularities of distribution in the lowlands. The small temperature differences between the "crowless" foothills and the inhabited valleys cannot be considered significant. Topographical and soil differences in hill and valley lands are probably more directly concerned with crow distribution and will be discussed presently.

Water.—Crows have access to fresh water in natural streams, rivers or sloughs in each of the 68 territories of the State. All sizable rivers have crow territories scattered along them in the lower altitudes and where the water is fresh. The absence of crows from the Suisun area is possibly attributable to the brackishness of the water there, for crows abound along the Sacramento River down to this point. High alkalinity of the water may possibly account in part for the absence of crows along the west side of the San Joaquin Valley.

Fresh water is probably an essential element of crow habitat. Such water, however, is available widely beyond the crow's range. The absence of the birds from all water courses on shallow soils and rocky areas suggests that the primary relationship is with the alluvium found in association with streams and rivers on the lowland plains rather than with the water itself.

Soils.—Crow distribution shows a significant correlation with the areas of deep alluvial soils of recent geological origin which cover only about one-tenth of the total surface of the State (fig. 79). The largest winter flocks are located on the broader expanses of soil of this description, and every territory reported has at least some of it. In many places the boundary line of crow range coincides with that of this soil type. The correlation, however, is far from complete, for there are large areas of deep alluvium on which there are no crows in winter.

Vegetation.—It is improbable that soil type in itself has any great significance to the crow except as it influences the vegetation. Recent alluvium of deep profile in California naturally produces a grassland association with open stands or widely scattered groves of oak trees, and with rows of cottonwoods and willows along the water courses. Just such an open country with a scattering of timber appears to be the natural winter habitat of the crow in California. The lack of trees on alluvium along the western side of the Sacramento Valley may account for the absence of crows there. The abundance of trees on the well watered alluvium of the north coast may explain the narrow restriction of crows in that region to the vicinity of clearings. "Parkland" associations containing what appears to be a suitable interspersion of trees and grass occur beyond the winter range of the crow in the shallow-soiled foothills and on many tracts of valley alluvium. Whether the absence of the birds on such areas is attributable to soil, water, a qualitative character of the vegetation, or some other factor is open to conjecture.

Vegetation probably exerts its greatest influence on a bird population through the food and cover facilities which it affords. Crows are notably adaptable with respect to both these factors, and it is difficult to see how either could be responsible for the restriction of the birds to a single more or less uniform habitat type. Perhaps this relation to the vegetation is due not to environmental pressures acting on the toleration limits of the species, but to an innate preference for a special habitat type such as has been described for certain British birds by Lack (1933, 1934, 1937). Elton (1930, p. 51) has indicated that a sense of "awareness of environmental harmony" probably has a wide application in the animal kingdom.

The relationship of the crow to vegetation in California has been immeasurably complicated by the drastic environmental disturbances produced by civilized man during the past hundred years of agricultural development and expansion.

Agriculture.—The close correlation of crow distribution with agriculture has been noted and discussed by numerous observers. Agricultural crops are extensively utilized by crows and, in fact, provide more than half of the food supply for the species (Kalmbach, 1939). Every crow territory in California includes some cultivated land; the largest ones are found on areas which are extensively cultivated (fig. 80C).

It is often assumed that this close relationship with agriculture is the result of a direct adaptation by the bird to the food supply provided by farm products. There is considerable reason to believe, however, that such is not the case, and that the fundamental relationship is with the land itself. The first line of evidence for this statement comes from the historical record which, as we have seen, points to a stable winter range extending back as far as the records go—5 to 50 years in California and up to 125 years in New York State. This covers a period during which agricultural developments have been extensive.

More definite evidence for the absence of any direct relationship of crow distribution with agriculture, is provided by statistics on the geography of important food materials. Grain, which today forms the largest item in the food of the species, is grown extensively on shallow-soiled foothill lands and on many alluvial areas which still remain untenanted by crows (fig. 80B). Nuts are eagerly taken by crows when available in their winter territories, but are untouched in the large orchards that lie beyond the limits of crow range, as in San Luis Obispo, Colusa, Contra Costa, and other counties (fig. 80A). Crows have benefited and, in certain areas, have increased under man's improvement of the natural range. They have, however, apparently failed to take advantage of new food supplies opened up for them during the past hundred years outside of this range.

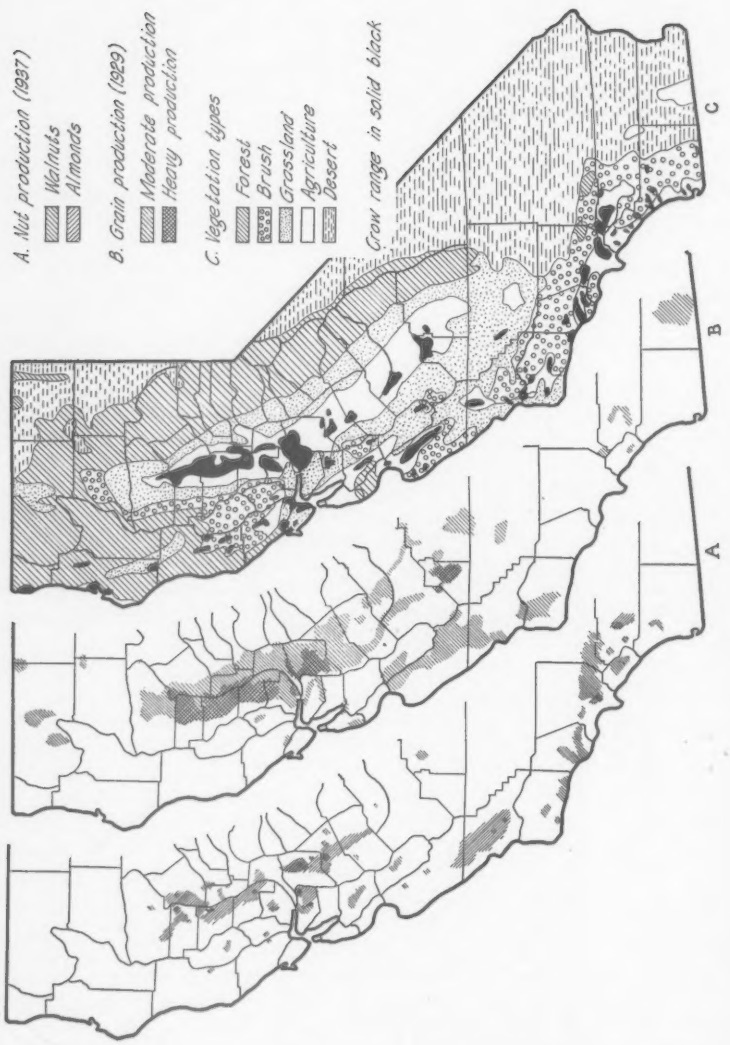

Fig. 80. Winter distribution of crows in California in relation to certain aspects of the vegetation.

Along with food-producing crops, agriculture has introduced broad irrigation ditches and scattered groups of shade trees into formerly arid and treeless plains, thereby creating a supply of water and arboreal cover as well as of food. There are numerous reclaimed areas of this type on good alluvial soils in the Great Central Valley, the Imperial Valley and elsewhere which, to the human eye, appear to afford the requisites of crow habitat, yet no birds are there. This might be more understandable in the case of a less adaptable species, but the crow has shown itself to be highly adaptable to environmental changes within the confines of its range.

Subjective factors.—From the foregoing account it appears that wintering crows adhere year after year to a rather definitely prescribed range despite the presence of preferred foods, cover, water and other attractive environmental features elsewhere. It is not likely that the birds have simply failed to discover these apparently suitable areas beyond their range, for crows migrate through and even nest on many of them. Some definite restraining factor seems to be involved. It is conjectured that this factor is an innate drive to return each winter to established (familiar) territory.

For many years it has been recognized that animal distribution is a dynamic and not a static phenomenon. Grinnell (1914, 1917, 1928), Howell (1922, 1924) and others have pictured the centrifugal pressure by a species on the boundaries of its range, and the counter role of retaining barriers, either of the rigid physical type or of the more elastic climatic, associational and competitional types. To this barrier concept Elton (1927) has added an innate factor acting in restraint of dispersal, a power of selection of attractive environment which tends to restrict the animal to areas in which optimum or at least favorable conditions prevail. The innate drive to return to traditional winter territories which we have just postulated for the crow is similar to this last-named "exercise of choice" factor proposed by Elton, but differs from it in emphasizing familiarity with territory as the principal objective rather than attractiveness of habitat.

Support for a non-environmental factor in bird distribution is provided by studies of the homing instinct in pigeons, and by demonstrations in recent years of the wide occurrence of the homing drive in wild birds. These studies have shown that strangeness of surroundings, such as would be encountered by a straggler beyond the boundaries of the familiar home range, is a prime incentive to homing flight (Whitman, 1919, p. 136), and that a particular locality implanted in the bird's nervous mechanism, not a habitat, is the goal. Schmidt (1930, p. 287) has postulated the importance of homing phenomena in the endemism of island avifaunas, stating that the homing instinct "may condition the return of wandering individuals and thus increase the effectiveness of their insular isolation" (Hesse, Allee and Schmidt, 1937, p. 126). This concept of a homing factor acting in restraint of territorial expansion should also be applicable to distributional problems on the continental mainlands where barriers are only slightly less definite to highly mobile animals. It should apply particularly to flocking species like the crow in which social bonds are highly developed.

SUMMARY

1. A survey of the midwinter crow population of California was conducted during the winter of 1937-38 with the cooperation of various state agencies. A total of 82,000 crows in 68 population centers was reported.

2. Population densities on California crow territories were low as compared with those recorded in the eastern states; they varied from 5 to 25 birds per square mile.

3. Territories were largest and populations heaviest in the Sacramento Valley. Flocks in the coastal regions were small and scattered except in the lowlands of Los Angeles and Ventura counties.

4. Crow populations have apparently increased in the north coast region and in the Sacramento Valley during the past 5 to 50 years but have not changed appreciably in other parts of California.

5. No appreciable changes in the location or conformation of the winter territories of crows have been noted in the past 5 to 50 years.

6. Climate apparently plays only a minor role in delimiting crow distribution in California.

7. Crow distribution shows definite but incomplete correlation with factors of altitude, water, soils, land cover and agriculture.

8. Crows have adapted themselves to environmental changes on their established winter territories, but have failed to extend their range on to areas supplied by agriculture with preferred foods, water and scattered timber.

9. Evidence is presented for the existence of an innate affinity or homing reaction to established territory which, independent of environmental factors, acts in delimiting the winter distribution of the crow in California.

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A BEHAVIOR STUDY OF THE WHITE-TAILED KITE

WITH ONE ILLUSTRATION

By FRANK GRAHAM WATSON

This paper treats mainly those activities of the White-tailed Kite (*Elanus leucurus*) which have sexual significance and which take place in the early half of the reproductive cycle. It is a study of behavior having a broader coverage than is embraced by the term "courtship." Observations were carried beyond the prenuptial period and, since they were made in a region where the population was denser than is usual for kites, a study of the relationship between neighboring pairs was possible.

About 53 hours were spent in field observation. A large portion of this was spent in the study of two adjacent pairs of kites. The activities of one of these pairs, henceforth referred to as the "north pair," were studied in detail; the activities of the second, or "south pair," were noted for the most part only when they concerned the north pair. The remainder of the time was devoted to censusing, and to observing the foraging methods and other activities of other pairs. The intermittent nature of the observations made impossible a study of the gradual changes in behavior. However, the fact that visits were made at regular weekly intervals minimizes the effect of this lack of complete data.

These studies were carried on in the San Joaquin delta region of California where, protected and isolated by the sloughs, the kites find willow-covered marshy islands on which to nest and large open areas, for the most part under cultivation, in which to forage. Observations were made from a car parked at an estimated distance of 50 yards from the nest. This distance had certain disadvantages, but was satisfactory in that once the observer was settled the birds paid no attention to him.

In a study of this nature it is obviously necessary to be able to identify the individual birds. Fortunately distinguishing between the two members of the north pair was rendered simple by the fact that the male, on the first day of intensive study, had a broken remex near the dividing line between primaries and secondaries. The gap resulting from the subsequent loss of this feather was present at least until the study was terminated. During this whole period the female appeared to be in perfect plumage. In addition to this, there are certain natural sexual differences recognizable in the field. The female is noticeably larger than the male and the gray of her back and wings is darker. In flight she is steadier and has a wing area appearing proportionately greater than that of the male. These differences were constant in the several pairs observed but, being of a comparative nature, it was necessary to see both birds if they were to be used.

NARRATIVE

This section is devoted to a narrative of the behavior of the north pair of kites. It shows how behavior changed with the season, how the birds divided their day into various periods of activity, and serves as a framework in which certain of these activities, to be described in detail later, can be oriented.

Observations on this pair were made as follows:

February 4, 1940	11:15 a.m. to 11:45 a.m.	½ hour
March 3, 1940	7:50 a.m. to 4:50 p.m.	9 hours
March 10, 1940	6:00 a.m. to 10:45 a.m.	4¾ hours
March 17, 1940	6:15 a.m. to 10:10 a.m.	4 hours
March 23, 1940	4:02 p.m. to 6:50 p.m.	3 hours
March 24, 1940	5:18 a.m. to 3:18 p.m.	10 hours
March 31, 1940	5:15 a.m. to 1:00 p.m.	7¾ hours
		39 hours

On March 3, 10, and 31 observations of this pair were also made for short periods in the late afternoon, observations of other kites having been made in the meanwhile.

At the time of the first observation on the north pair the sexual bond had already been formed. The two birds were observed perched near each other for some time. Finally one flew, going out to forage, and in a few minutes the other followed. Another mated pair was also watched on the same day. For about half an hour they were perched in the top of a dead willow only two or three feet apart. Only once did one of the two leave, going then to chase a Marsh Hawk (*Circus hudsonius*) which flew close by. On this date foraging and perching near each other were probably the only activities of paired kites.

I do not know when behavior actually connected with reproduction started, for on March 3, the next day of observation, copulation and work on a nest had already commenced.

A kite's morning meal, eaten shortly after dawn, usually consists of one small mammal. This meal evidently was finished when I arrived about 8 a.m. on March 3; the birds were perched, motionless and quiet. A few minutes later copulation was observed, the kites then becoming inactive again for almost two hours. During this time they preened and called occasionally. There followed a 20-minute period, initiated by a copulation, during which the birds worked on their nest. From 10:10 a.m. to 1:20 p.m. was another period of inactivity. The two kites perched low on the lee side of a clump of willows, sheltered from a rather strong wind. There they sat near each other and preened, the female almost continually, the male less frequently. Occasionally they called. This three and a half hour interval was broken when both birds flew out and returned to the nest with twigs. During the rest of the afternoon, until observations were terminated at 4:50 p.m., the male spent most of his time foraging. In this time three of the small mammals he caught were eaten by the female and three by himself. His forays were interspersed with three more copulations.

A week later, March 10, observations began at 6 a.m. The kites, perched in the half light, evidently had not begun their day's activities. Several minutes later copulation took place and then the male went out to hunt. Returning shortly, he passed his catch to the female. This morning, at least until 10:45, when observation ceased, there was considerable activity. At 7:05 a territorial fight took place with the pair to the south. Later twigs were brought to the nest, copulation occurred four additional times, the male made nuptial flights, and several times patrolled his territory. Later in the day I made two short observations. At 1:15 p.m. the male was observed foraging and at 4:20 the pair was seen near the northern boundary of their territory, at which time copulation occurred.

On March 17 I arrived at 6:15 a.m. At that time the male was away but shortly returned with a mouse. On this morning the kites each ate 1½ mice, the male as usual doing the foraging. They flew to the south, alighting in a piece of newly-gained territory, and copulated. The female stayed perched there almost an hour while the male brought a stick to the nest and made several nuptial flights. When the female returned, she brought a twig to the nest. Copulation then took place, after which the male made several trips to get nest material. About 9 a.m. the wind became rather strong and the birds soon repaired to the sheltered low willows where they habitually perched close together under such circumstances. They were still there when observation ended at 10:10 a.m.

On March 23 I arrived at the territory of the north pair at 4 p.m. At that time the female was on the nest incubating. The male, which was perched nearby, soon went foraging. When he returned with a catch, the female left the nest, went to a dead willow

perch, and began preening. About three minutes later she flew to the male's perch and got the mammal which by then he had partially eaten. After she had eaten, they copulated twice, the two acts being separated by an interval of 13 minutes. The male then brought another mammal which the female ate. After that they each brought one twig to the nest and the female then settled on the eggs after having left them uncovered for 40 minutes. The male then preened awhile and later caught and ate two mammals. Until it was almost dark, he perched near the nest and then flew off, probably to a sheltered perch he habitually used at night. The female was still on the nest when I left after dark.

The next morning at about sunrise the male was heard calling from the direction in which he had gone the night before. Soon he arrived and perched in a dead tree not far from the nest. He remained there until the female left the nest three-quarters of an hour later. Immediately they copulated and then the male went hunting. He soon returned with a mammal for the female. When finished eating, she obtained a twig, took it to the nest, and then resumed incubation. For the next two hours almost continual preening by the male was the only activity noted. After this the male flew off, returning with his mouth full of limp-looking straw. As the male deposited this in the nest, the female left. In the next six minutes copulation was noted twice. The male then went hunting and on his return brought a small mammal, which the female ate. A few minutes later she made an unsuccessful attempt to break a twig from a willow tree, then returned to the nest to resume incubation. For nearly half an hour the male preened, then flew off to hunt. When a motor boat passed near the nest, the female left it and flew to a perch on a dead willow. She preened and continued to do so as the male ate a mouse he had brought in. Later she took a twig to the nest and again incubated. From 10:12 a.m. to 1:39 p.m. was a period of prolonged inactivity. The incubating female did a little preening; the male, which was perched, also did some preening. At the end of this period the male went hunting. He remained away longer than usual and when it began to rain about 2 p.m., he was still away. At 2:20 he returned and perched, his hunt unsuccessful. He spread his wings and tail in the now heavy rain, using this as a means of bathing. At 2:38 the female left the nest and joined him in bathing. By 3:18 the condition of the roads, due to the heavy rain, was so poor that I had to leave. By then the female had been off the nest 40 minutes and showed no signs of returning.

On March 31 the first sign of activity was the calling and then appearance, at 5:32 a.m., of the male from his overnight perch, perhaps 75 yards from the nest. During the next 40 minutes he made several flights about his territory but showed no evidence that he had been foraging. In the course of one of his absences the female, which had been incubating, spent a four-minute period off the nest, shaking and preening herself. When the male's flights ceased, he preened for about half an hour, then, at 6:45, went foraging. At 6:47 the female left the nest to receive in mid-air the mouse the male was bringing. After eating this, the female returned to her incubating while the male spent most of his time preening. Observations were continued until 1 p.m. Up to that time the female did not leave the nest. The male interspersed his preening with a few nuptial and patrol flights and brought one stick to the nest. The period, as a whole, was one of little activity.

BEHAVIOR

Pairing.—It seems probable that the White-tailed Kite, a resident species, once mated, thenceforth remains paired. Whenever I have seen kites they almost always have been in pairs. Unfortunately, I have never observed them in late fall or early winter, the period when sexual bonds would be most apt to break, so it is yet possible that this latter may happen. However, with the exception of but two kites, all I saw after February 4 of 1940 were paired. It is probable that odd birds wander, as I found that the two mentioned above did, and await their turn to fill in a gap in the resident population.

Territoriality.—A bird as rare as the White-tailed Kite might be expected to be well dispersed, with each pair well isolated. This is often the case, but when conditions are favorable it is found that kites group together, forming moderate-sized communities. However, this does not mean that they are in any sense colonial. The pairs of kites remain spaced out over this favored area in a fairly uniform manner, but close enough in most cases so that territorial boundaries must be determined.

At least the general outlines of these territories must have been formed by February 4 in 1940, for on that date the pairs of birds observed were perched at approximately the places they used later when territories were well established. The territory of the north pair in its final form is shown on the accompanying map (fig. 81). Part of the boundary of the territory of the south pair is also shown. On March 3 the male of the north pair covered all parts of his territory except area E, that small portion marked off at the south end. This area, it was discovered, was then part of his neighbor's territory.

A week later, on March 10, one hour after sunrise, the north male, followed shortly by his mate, flew from near the nest directly to area E. On arriving at this small bit of the island they immediately perched on dead willows. It was not more than a few seconds before they were beset by one and then both kites of the south pair. All four birds engaged in the ensuing tussle, each singling out one of the other pair. Because of the speed of the action, I could not determine whether they chose an opponent of the same sex. The opposing birds towered up to about 150 feet, high for kites, each trying to gain a superior position. Finally they would engage each other, grasping with their feet the leading wing edge or the feet of the opponent. Once or twice the bill was used to hold an opponent's wing. Tangled up in this way, they would be unable to fly and would tumble earthward, a whirling mass of wings. When about half way down, they would lose or release their holds and separate, immediately flying up again to start over. Each of the two sets of birds repeated this about four times. By then the invading pair began to retreat and were soon in hasty flight back to their home ground followed by one of the south pair which dived at them as they fled. The activities of the south pair shortly afterward took them to the southern part of their own territory whence they evidently were unable to detect the return of their neighbors to the disputed bit of territory. The female of the north pair stayed in area E almost 45 minutes undisturbed. Later in the morning the north pair made two more trips to this spot for nest twigs and they copulated there once.

A week later, March 17, possession of this spot by the north pair was undisputed. They copulated there early in the morning, then brought twigs back to the nest. Later the female spent half an hour perched in E while the male twice brought sticks from there. Apparently by perserverence they had increased the size of their territory. Such extended flights and long periods away from the immediate nest region were quite unusual behavior for the female. It may be that to feel in complete possession of their territory both members of the pair must be familiar with it. This is supported by the fact that I only once saw the male at the island marked F and at that time he was in the company of the female. Copulation took place there as well.

The territories of the north and south pairs also bordered between the foraging areas B and C. The male of the north pair used B regularly and always restricted himself to the area as shown on the map. The male of the south pair evidently did most of his hunting to the west, for his visits to area C were infrequent, though he did use it for foraging and at least twice he entered area B. On one of these occasions he was discovered by the north male which, by several dives and swoops, drove him out. Twice, also, the male of the south pair was caught foraging in area A whence he was immediately ejected by the

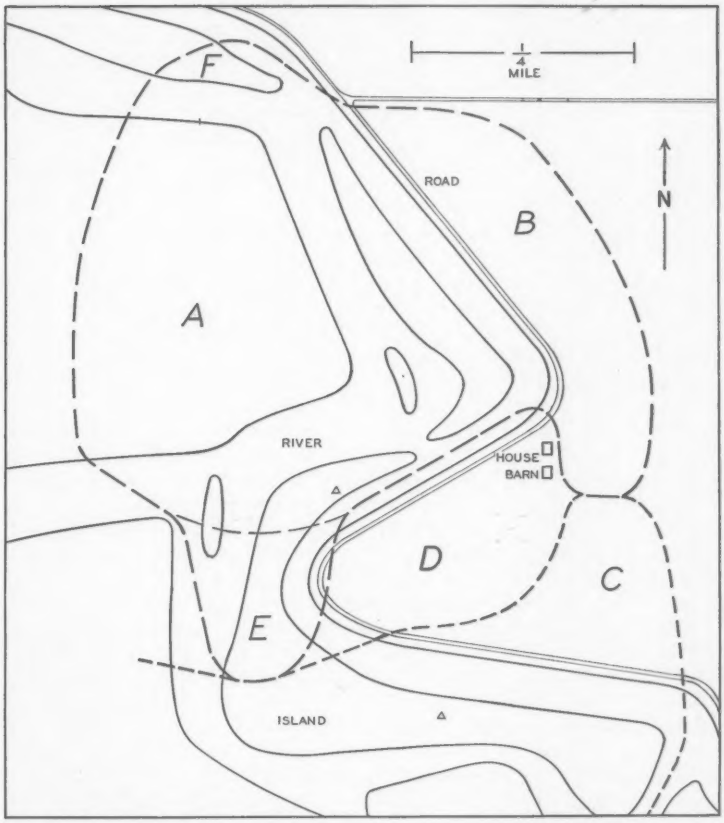

Fig. 81. Territories of White-tailed Kites in San Joaquin delta region of California. Broken lines mark boundaries. Areas A, B, E, and F constitute the territory of the north pair as finally determined; Area C, and earlier E, belonged to the south pair (see p. 298); D was unoccupied ground. Triangles mark nest locations.

owner. In both cases the intruder left flying straight for his home roost, coming south over the nest and area D. He never ventured to reach area A by this route; had he done so, he surely would have been detected. More likely he circled into it from the west, in which direction part of his own territory probably lay.

Usually two or three times a day, sometimes oftener, the north male went out on what were seemingly patrol flights. On these he covered a large part of his territory, flying in a normal and direct manner. Foraging would not be confused with patrolling activities, for the former could be recognized by the specialized methods of flight which are used. He was by no means such a vagrant as was the south male. During my periods of observation he never ventured beyond his territorial boundaries after they reached their final position. In observance of these limits the female was just as strict as was the

male. Even though the boundary line was only fifty yards from the nest, she was not observed to cross it. Since she did not engage in patrolling or foraging, and as her trips for nest material were usually quite short, she had little occasion to leave the area.

From my study of the north pair I have arrived at certain conclusions regarding the factors which controlled the size and shape of their territory. For some distance to the north there was no suitable nesting site for another pair of kites. Therefore they were free to move from their nest region as far as they needed. This need was apparently controlled by the availability of food. Areas A and B were able to supply it. To the south and probably to the west they were bounded by the territory of the south pair. Area D to the southeast is a depressed region, much of which, during the period of study, was covered by a thin sheet of water. This area, surrounded by the two territories, was claimed by neither pair and was not used for foraging, nor was it patrolled by either male. Since a large proportion of the area defended was used for foraging, and since useless ground remained unclaimed, it seems that, in this species, maintenance of territory is important as a guarantee of food supply. The right to an area will be supported by both members of the pair if need be. Thus the territory is the kite's own game preserve.

Foraging.—Although the subject of foraging might not be expected to come within the scope of this paper, certain aspects of it have a sexual significance. The main point is that during the courtship and incubation periods foraging is done by the male only. Not once was the female of the north pair or of any other pair observed engaged in hunting. Although 53 hours of observation spread over five weeks' time do not prove that females do not hunt at this season, the feeding behavior followed so uniform and definite a pattern from week to week that I feel the statement can be made with a fair degree of safety.

In spite of the fact that the male provided all the food for both birds, he was not overburdened. He was able to secure a sufficient number of small mammals for himself and his mate during a short period in the early morning and a more extended period in midafternoon.

Usually the female's hunger was satisfied, or at least partially so, before the male ate anything. For example, in his afternoon hunting period on March 3 the male caught 6 mammals. Of these the female ate numbers 1, 2, and 4, and the male ate 3, 5, and 6. The male occasionally relieved his hunger before the female was well satisfied by eating what he caught while perched at a distance. The above case also illustrates this point. Catches 1, 2, and 4 were the first three which were brought to the perching area. The male ate catch 3 while away, but brought 5 and 6 back before eating them, the female apparently being no longer hungry.

One of the ways in which the food is transferred from the male to the female is most spectacular. When about 100 to 150 yards away the male begins repeating the single note *kewp* as he approaches with a small mammal. The female then leaves her perch, or the nest if she is incubating, and flies to meet him, calling *eee-grack* as she goes. When they meet, it is usually at an elevation of about 50 feet. The male, half hovering, flies along slowly and holds the mouse with feet extended well below him. They both call *eee-grack* as the female flutters along behind and beneath the male. Finally she is close enough to turn her body to a vertical position and to reach forward and upward to grasp the mammal with one or both feet. Just at that moment the male hovers still and then, when the female has the prey, he flies off. The female swoops downward and then flies to a perch, where she eats.

The above method and the following one are used with nearly equal frequency. In the second type the female does not fly out to meet the male, even though he usually calls while approaching, but waits for him to arrive. The male may then perch next to

the female, but more often he does not. In such cases the female flies over and perches next to him. There is then *eee-grack*ing and a fluttering of wings by both as the female grasps the mammal with her foot. Sometimes there is quite a struggle before she gets it, but she always succeeds. The seeming stubbornness on the part of the male may be the result of a desire to keep his catch, but this seems unlikely since he always loses it. Perhaps his resistance is a form of sexual "teasing." Similarly, when the transfer takes place in midair, the male sometimes moves along rapidly enough so that the female is continually just out of reach of the food while they traverse a distance of 50 feet or more. He would be quite capable of hovering in one spot while the transfer took place.

Usually when the female was no longer hungry, the male would bring his food to a perch near the nest and eat it, the female paying no attention to him. A few times this was apparently the situation, but after he had been eating for a short while, the female flew to his perch and got the remains of his meal, there sometimes being less than half the mammal left.

Copulation.—On March 3, the first day of intensive study, copulation was observed. Since it took place as frequently that day as on any later date, it is probable that it had been going on for a number of days. It was observed each successive week-end until March 24, but was not noted in 7¾ hours of observation on March 31. The copulation period, therefore, lasted at least 22 days. Of this period, 15 to 20 days were before incubation began, the uncertainty resulting because the first day of incubation was not determined.

The frequency with which copulation took place varied but little. It averaged slightly less often than once for each hour of observation. On March 3 it occurred at about even intervals during the day, but later tended to occur in the early half of the morning and the latter half of the afternoon.

Copulation took place only when the female was perched on a dead willow branch. The male would fly to her, hover, and drop to her back. There he would dig his claws into the feathers of the female's pelvic region as he stood still a moment, with his wings half spread, while the female assumed the proper position. She would lean forward so that her back was horizontal or sloping slightly forward and would raise her tail to a vertical position, most often to the left side of the male. At the same time she would spread and droop her wings. There would then be a juxtaposition of the two cloacal regions, the male meanwhile fluttering his wings; after 3 or 4 seconds he would fly away. Following this the female would hold her position, wings limp and tail raised, for about 2, sometimes fully 3, seconds, and then suddenly snap back into a normal perching position. During the whole performance they called *eee-grack* continuously.

The actual time of conjugation, as stated above, is only 3 or 4 seconds. This short time and the generally inept appearance of the act lead me to believe it is rather inefficient. Probably the frequency with which it is done compensates for this.

The stimulus calling forth the mating act is rather vague. In a majority of the cases copulation occurred in an otherwise inactive period. Most often the two birds were perched near each other, perhaps preening, when the male would fly to, and mount the female, the "releaser" for the action being, to me, entirely undetectable. Occasionally it occurred when the birds had just put twigs in the nest; twice it occurred when the birds were visiting new territory, and once the male mounted the female directly upon returning from patrolling his domain. Twice during the incubation period it took place almost immediately after the female left the nest. Once only, on March 3, was it preceded by posturing of the female. On this occasion she assumed the position she takes during copulation and, in addition, fluttered her wings. The male, which was about 40 feet away, immediately responded.

Nest building.—Whether the same nest is used in successive years I do not know. At all events, on March 3 the nest eventually used by the north pair, and the only one seen in the territory, was a well-formed structure. In a month's time it did, however, gradually develop a more substantial appearance.

The work on it was done in about equal shares by the male and female, although in general they did not work together or at the same time. Within my periods of observation material was brought to the nest 23 times. On only four of these trips did the birds cooperate. In one case each bird carried a twig as they returned together from the area they had newly acquired from the south pair. On another occasion the female flew out while the male was foraging and they returned, flying close together, each with a twig. More often one or the other bird went for a twig shortly after copulation took place or, as already stated, the two acts were sometimes performed in the reverse order. The female often got a twig soon after eating and went to the nest with it. This she continued to do into the early part of the incubation period. She would leave the nest as the male approached with food for her, eat, then fly to near-by willows for a twig. Returning to the nest with it she would then resume incubation. The male's work was not often connected with other activities. He occasionally worked quite alone, a few times even when the female was out of sight.

Most of the twigs were gathered within 50 yards of the nest. The bird would alight in the slender outer twigs of a willow, seize a near-by one in its bill and begin tugging. Occasionally breaking the twig proved to be an impossible task and the bird would fly away. Almost always it was difficult enough so that the bird would have to lean far back and beat its wings. When the twig broke, as often as not the bird would lose its balance and fall over backwards. There would then be a second or two of fluttering while it extricated itself and the twig. It would then fly to the nest, hover above it, and finally drop straight down into it. Usually very little time was spent arranging the twig in the nest before the bird left or began incubating. The female was seen to bring only twigs, usually from 6 to 12 inches long. The male brought, in addition to similar material, one reed and, while the female was incubating, a large mouthful of limp-looking straw.

Incubation.—March 23 was the first day on which incubation was observed. Since the nest was never closely examined, it is not known when the eggs were laid. Judging from the activities of the birds on March 23 and 24 I believe incubation had just started. Their behavior had changed little in other respects. Copulation and the bringing of nest material took place to about the same extent as previously, whereas on March 31 no copulation was observed and only one twig was brought to the nest.

I believe incubation is carried on entirely by the female. She was the only one seen incubating during the day and was on the nest both at dark and at dawn the night of March 23-24 and at dawn on March 31. At dusk the male flies off and perches in a sheltered spot about 75 yards from the nest and returns from that spot the next morning.

During incubation the female sits still for the most part but often turns her head as if looking about. She sometimes preens a little. The male, meanwhile, perches near by or goes foraging.

Flight.—The male White-tailed Kite has a very specialized courtship flight. From its characteristic appearance and for purposes of note taking, I have called it "quiver-flight." The bird may begin it either while flying in the usual manner or immediately after leaving a perch. He raises his fully extended wings to about a 45-degree angle and beats them extremely rapidly through a small arc of perhaps 10 to 15 degrees. At the same time the tail is closed and extended in line with the body. The feet may be either extended downward or kept up under the tail. While doing this, the bird progresses at

only a moderate rate and has a dainty, butterfly-like appearance. In spite of this it must be using a considerable amount of energy since the wing movement is very rapid and the whole body vibrates during the process. There is, in addition, a vulture-like rocking from side to side.

This performance was not seen on March 3, but it was done seven times on March 10 and about as frequently thereafter. Evidently it first appears in the sexual cycle later than such activities as copulation and nest building. A possible reason for this is that the performance is not necessary as a means of securing a mate or as stimulating copulation in this species. It is only one part of the complex of breeding behavior that serves to hold the pair together. Thus within rather broad limits it would make little difference when it appeared.

Quiver-flight seemed to function solely as a display and most often occurred with the female as a spectator. Usually it was done when the two were perched near the nest or when the female was incubating. The male would suddenly leave his perch, proceed with quiver-flight for about 50 to 75 yards, circle, and then return to his perch flying with deep wing strokes in his customary manner. A few times while the female was gathering nest material, she was accompanied by the male which flew in this manner, and once he flew in quiver-flight out to meet her when she was returning to the nest with a twig. On March 10 I made the following unduplicated observation. The male was foraging about 400 yards from the nest. He stopped his hovering with a sudden shift to quiver-flight and immediately turned for "home." This he continued for as far as I could see, which unfortunately was not the whole distance to the nest.

The male uses another type of flight which, though distinct, could easily be confused with quiver-flight. The wings are beaten through a rather shallow arc just slightly above the horizontal, while the legs are always extended downward. It is often used when circling about near the nest as is done when bringing back a mammal for the use of either bird or when returning from a quiver-flight excursion. Once, as already explained, the male chased a neighbor from his feeding area B. In so doing he interspersed his dives at the intruder with short periods of circling about in flight of this type.

The female always flew either with ordinary steady wing beating or by soaring and circling, although outside the courtship and incubation periods she engages in foraging and consequently must use other types of flight.

Voice.—In the White-tailed Kite there is no apparent sexual difference in voice. The two types of calls which the species gives are used by both sexes.

The first of these, and the one most frequently employed, is a low rounded whistle or chirp which may be written as *kewp* or *tewp*. It is probably uttered in less than half a second and may be soft or strongly accented. This note is used as a means of recognition or announcement of presence. The male calls in this manner as he approaches the nest region with food and he is usually answered in like manner by the female. He also gives it both before and as he arrives at the nest in the morning from his overnight roosting place. This note is used under a great many other circumstances, most of them impossible to analyze from the data at hand. While perched near each other and occupied with preening, members of the pair give it at irregular intervals.

The other call is one of excitement or uneasiness. It can be represented by the words *eee-grack* or *whee-grack*. This is its simple and most-used form. The note *eee* is a very high pitched, thin whistle. By contrast the *grack* is a low, extremely guttural, raspy sound. Each part may be used separately or one or both parts may be used in multiples. For instance, in copulation, as the male approaches the female, a series of *eee*'s, probably given by both birds, is heard. When he mounts the female, *grack*'s are alternated with the

eee's. The pattern is the same when a mid-air transfer of a mouse takes place—a period of approach when *eee*'s are heard and a period when the two birds are together during which *grack*'s are given. When the birds are disturbed by either a human or avian intruder, usually only one or two *gracks* will be heard.

Twice it seemed that the female also used the *eee-grack* call as an expression of hunger. Once while perched and once while incubating she began giving it at fairly regular intervals of perhaps 20 seconds. Each time when she did this, the male went out hunting. Thereupon the female ceased calling, and on each occasion the male brought back a mouse for her. In addition, this call is given frequently when no reason can be ascribed for its use. The birds, though by no means vociferous, rarely go silent for more than a few minutes.

SUMMARY

In the San Joaquin delta region of California a White-tailed Kite community of ten pairs was studied. Their territories, in most cases contiguous, followed a slough and stretched along it for 5.8 miles. One of these pairs was studied in detail during the early half of their breeding period. It is believed that kites are permanently paired, yet there is a definite courtship period. In courtship the male has a characteristic flight display. Work on the nest is done by both members of the pair, but the female alone incubates. White-tailed Kites are strictly territorial, the main function of the region controlled being to provide the required food supply which consists of small mammals. During the courtship and incubation periods the female does not hunt; the male supplies the food for both. The female concerns herself only with those functions directly connected with reproduction, although if necessary she will aid in territorial defense.

Berkeley, California, August 9, 1940.

FROM FIELD AND STUDY

Third Record of the King Eider in California.—I collected a juvenal female King Eider (*Somateria spectabilis*), now preserved as no. 1659 of my personal collection, at the mouth of Tomales Bay, Marin County, California, on December 16, 1933.

The bird was shot at 9:30 a.m. in the middle of the narrow channel which forms the entrance to Tomales Bay, about 200 yards east of Avalis Beach (see U. S. G. S. map, Point Reyes Quadrangle), at a point where the water is 45 feet deep. It was one of a group of three eiders which was found resting on the surface there. One of the other birds was either a juvenal or immature male and the third, a female of undetermined age. An hour later, I crippled but lost either the latter or another female eider as it flew along close to the shore a hundred yards north of Avalis Beach. This bird was hit hard by a charge of shot while it was flying about ten feet above the surface, whereupon it dropped to the water and dove immediately. It apparently swam so far under water that it was not seen when it finally came to the surface.

The specimen that was secured is mainly in the first plumage and is definitely a bird of the year. A small percentage of the flank feathers, most of the contour feathers of the back from the interscapular region to the rump, and the scapulars are of the succeeding plumage. This bird measured 550 millimeters in length and weighed 3 pounds 1 ounce; it was in rather lean condition with nearly empty stomach.

There are but two published records for occurrences of *Somateria spectabilis* in California. Henshaw (Bull. Nutt. Orn. Club, vol. 5, 1880, p. 189) recorded a young male from near Black Point, San Francisco Bay and Loomis (*fide* Grinnell, Bryant and Storer, Game Birds Calif., 1918, p. 193), a female from the Suisun Marshes, Solano County. Neither of these localities presents eider habitat and the birds were doubtless vagrants. The environment at Tomales Bay where my bird was taken is more characteristic of the species' maritime winter habitat and the fact that three or more individuals were seen indicates that at least a small company of King Eiders had migrated far south of their normal winter range. Ornithological observations are so few off the California coast in midwinter that it is possible that this eider is a more regular visitant than the few records would indicate. Other observers should be on the lookout for this species. Judging from my experience with these birds, eiders are easy to recognize by one familiar with other ducks. While I had never before seen wild, live eiders, I instantly recognized these birds as such when I first saw them a hundred yards distant. Their carriage is quite distinctive and not at all scoter-like, as might be supposed.—James Moffitt, *1879 Broadway, San Francisco, September 19, 1940.*

Western Mockingbird and Desert Sparrow in Southeastern Oregon.—During a brief stop at Burns, Harney County, Oregon, on May 25, 1940, the first bird notes that struck my ears came from a Western Mockingbird (*Mimus polyglottos leucopterus*) in full song. The bird was observed for fully ten minutes by several members of the La Grande Nature Club. Since Gabrielson and Jewett (Birds of Oregon, 1940, p. 462) record five specimens from the Steens Mountains and Blitzen Valley, it is not surprising to find that the species, possibly by following the Blitzen and Silvies Creek valleys, has found a welcome in the few shade trees of Burns.

Later the same morning, in the course of a half-hour stop at Wright's Point, a few miles south of Burns, an adult Desert Sparrow (*Amphispiza bilineata deserticola*) perched on top of a bush in front of me for perhaps a minute. It was at Wright's Point that Finley and Bohlman collected two of the three Oregon specimens recorded by Gabrielson and Jewett (*op. cit.*, p. 565).—A. S. Hyde, *La Grande, Oregon, September 16, 1940.*

American Redstart at Redlands, California.—On September 11, 1940, an adult male American Redstart (*Setophaga ruticilla*) was observed by us in a small group of pecan trees in Prospect Park, Redlands, California. The bird was extremely active, constantly fluttering through the green foliage, and flashing all the while its flaming red sides and orange wing and tail patches. Its sharp insistent call note was given at regular intervals. The bird was observed each day in the park from September 11 to October 21, 1940, and it seemed to restrict its activities to the same group of trees during the entire period, making accurate observation comparatively easy. The bird was also seen and identified as such by Herbert Hill who is familiar with the bird from observations made in the eastern states.—Milton Moore and Donald Moore, *Redlands, California, October 21, 1940.*

Sound Produced in the Nuptial Dive of Young Anna Hummingbirds.—Much thinking and some talking has been indulged in with reference to the source of the climax sound produced by the male Anna Hummingbird (*Calypte anna*) during its remarkable nuptial diving performance.

The only experimental work that has come to my attention is that of Rodgers (Condor, vol. 42, 1940, p. 86). He has brought forward strong evidence to show that the note is the result of vibration set up in certain of the tail feathers, particularly the outer ones, of the adult male.

When on Santa Ana Mountain, Orange County, California, this spring (May 21) I observed an interesting performance by an immature bird that bears somewhat upon the subject. Two birds of the year, with male characteristics of tail and gorget only partially developed, were rivals for the honey crop produced by a small patch of blossoming penstemons (*Penstemon spectabilis*). There was much charging and counter charging. Finally a series of typical nuptial plunges was indulged in by the more aggressive youngster. He rose to full height and came down with the characteristic speed to the same abrupt turn, which in this case was less than ten feet from where I stood. At this climactic point a distinct *flick* was heard. It was just as definitely marked off from any swish of the bullet-like descent as in the adult bird's performance, but it lacked altogether the approach to vocalized character that is characteristic of the adult of the species. It impressed me freshly with each performance as being a feather vibration and not a vocal note. His musical reed had not yet ripened to the full tonal possibility.—Loye Miller, *University of California, Los Angeles, California, September 19, 1940.*

A Saw-whet Owl Nest on Mount Pinos, California.—On June 9, 1940, Frank Brundige and I were collecting on Mount Pinos, Ventura County. While I was climbing to a Red-breasted Sapsucker's nest in the dead top of a tall pine tree, Frank scouted out some likely woodpecker holes in the near vicinity; two in particular looked very promising. After hitting one of the dead pine stubs twice with large rocks a small head appeared in an enlarged flicker hole. It so camouflaged the hole that when I came to see what the bird was, I was unable to find the previously prominent hole. With great difficulty Brundige was able to point it out to me.

Dead limbs formed a frail ladder to the nest, and soon we were on the way up. A Saw-whet Owl (*Cryptoglaux acadica*) flushed heavily from the hole, but stopped in a near-by tree affording us a good look at her. Her breast showed signs of incubation so we were heartened at the prospect of a breeding bird. The hole had been enlarged by decay and was only about five inches deep. It contained a newly hatched chick and five eggs. Because of constant pestering by a female Western Tanager, the owl flew away and did not return while we were at the nest.

The following week Brundige and Sidney Peyton returned to the nest and banded three of the young birds. The two others were too small for banding. Mr. Peyton removed the sixth egg, which was addled, and after some careful washing found that it was a light-colored Sparrow Hawk's egg.

The Saw-whet Owl is a rare breeder in southern California.—Edward M. Hall, *Whittier, California, July 22, 1940.*

Black and White Warbler in Northern Lower California, Mexico.—Records of the Black and White Warbler (*Mniotilta varia*) for Lower California are few. According to Grinnell (Univ. Calif. Publ. Zool., vol. 32, 1928, p. 197), the four recorded instances, all from the Cape region, were made in the months of September, November, December and February. The birds were either fall migrants or sporadic winter visitants.

The surprise of the writer may be imagined, when at dawn on June 13, 1940, he was awakened by the rather loud and often repeated song of a Black and White Warbler coming from a small willow tree beneath which he had spent the night. This was at a locality called Guatay, 5 miles south of the site of Mission San Miguel, or some 18 miles north of Ensenada, Lower California, Mexico.

The writer was unarmed and was obliged to content himself with a day-long visit with this vociferous rarity. The bird spent the greater part of the morning within a hundred feet of camp, where it was seen many times searching for insects over the limbs of the willows in its creeper-like manner. It sang almost continuously until the day became warm about 10 a.m., after which it was heard no more until past midafternoon, when it sang again less volubly. During the sunset hour it moved farther off into the dense willow thickets away from camp and next morning was not heard, although I listened carefully. Apparently it had departed in the night.

The locality of this observation was only about 35 miles from the California border. There are a number of published occurrences of the Black and White Warbler in southern California, but all, as far as the writer is aware, were in the fall or winter months. It is believed, therefore, that the Guatay bird provides the first spring record of this species not only for Lower California but also for the entire area of southern California and Lower California.—Laurence M. Huey, *San Diego Society of Natural History, San Diego, California, September 4, 1940.*

Black-crowned Night Heron Nesting in San Bernardino Mountains.—It was with considerable surprise that Mr. W. D. LaNiece and I found a small colony of Black-crowned Night Herons (*Nycticorax nycticorax hoactli*) nesting in Big Bear Valley, San Bernardino County, California. The

dozen nests were in a small patch of tules at an elevation of about 7000 feet. The nests were about a foot above the surface of the water and on June 2, 1940, they contained from two to six eggs, or newly hatched young.—WILSON C. HANNA, *Colton, California, June 3, 1940.*

The Spotted Owl Nesting in the Sequoia Belt.—About 4:30 p.m. on June 10, 1940, an owl and her young were reported from the Wilsonia Road about one-eighth mile south of headquarters at General Grant Grove Section of Kings Canyon National Park, Tulare County, California. Upon visiting the spot two young owls in juvenal plumage were seen perched on the roots of a large fallen log; the parent owl perched on a limb of a white fir two hundred feet away. The size, lack of ear tufts, and blackish eyes, helped identify the birds as California Spotted Owls, *Strix occidentalis occidentalis.*

A number of Kodachrome photographs were taken of the young birds, which could be approached closely. Examination of the down log revealed a hollow about two feet in diameter which looked as if it might have been the nesting site.

Nearly two weeks later one of the young owls, still unable to fly well, was captured by a camper. It was returned to the log where the other young one was found in the hollow. Mrs. Beatrice B. Nielsen watched the parent feed the young owl a small bird. In doing this she pulled off strips of flesh for the young. The last date on which the owls were seen was June 25, 1940.

This nesting of the Spotted Owl in Kings Canyon National Park at an elevation of 6600 feet in the sequoia belt, we believe is the first definite breeding record for this area. Marshall (Condor, vol. 41, 1939, p. 77) has mentioned its occurrence in summer at Whitaker's Forest, Tulare County.—HAROLD C. BRYANT, *Kings Canyon National Park, California, September 11, 1940.*

The Lark Bunting in Southern Nevada.—The only definite record that I can find of the Lark Bunting (*Calamospiza melanocorys*) in Clark County, Nevada, is that by Linsdale (Pac. Coast Avif. No. 23, 1936, p. 123) of a male (U. S. N. M. no. 138050) shot April 29, 1891, in Pahrump Valley. From an experience of my own in Clark County, in February, 1940, it seems strange to me that only one of several previous workers has recorded this species, which occurs more or less regularly during the winter south to Imperial County, California.

On February 4, 1940, in the yard at Corn Creek Ranch, some 36 miles north of Las Vegas, my attention was drawn to several dull-colored sparrow-like birds foraging among the fallen leaves and dry grass in an adjoining orchard. With the aid of binoculars I recognized them as lark buntings. While driving from Las Vegas to Boulder City on February 7, I saw about a hundred of these birds on the dry plains just west of Boulder City. The next morning they were still present in large numbers. A male of this species was picked up dead on the road on February 8, evidently killed by a passing automobile. On February 9 five lark buntings were seen in the orchard at Corn Creek Ranch; these had increased to eight by February 11. While driving through the town of Searchlight, some 37 miles south of Las Vegas, on February 12, 1940, I observed a hundred or more of the birds feeding among the sparse, dry vegetation in the southern outskirts of the town. The last one seen, a lone male, was on the dry creosote-bush covered plain near the southern tip of Nevada along the highway, just before it crosses the state boundary line into San Bernardino County, California.

These observations would indicate that at least in some years the lark bunting is a common migrant or winter resident in Clark County, Nevada.—STANLEY G. JEWETT, *Portland, Oregon, March 5, 1940.*

Comment on a Californian Record of the Western Tree Sparrow.—In Hellmayr's catalogue of the Fringillidae (Field Mus. Nat. Hist., Zool. Ser., vol. 13, pt. 11, 1938, p. 556), two birds are listed from "California (Butte County, 1; Hayward, 1)" under *Spizella arborea ochracea.* The late Dr. Joseph Grinnell upon seeing this, asked to examine the specimens. The following is from a letter from him to Mr. Rudyerd Boulton, dated April 5, 1939.

"No. 40049, Field Mus., bears on face of original label these data: '566. Western Tree Sparrow. Enterprise, | Butte Co., C?l. [Cal. or Col.?] 2/5/1896. ♂.'

"There is no collector named on this tag. After a great deal of comparing of the handwriting with signatures and correspondence I have from California collectors of the 1890's, I can find none to match. The little round label, with only the collector's number on it, and the violet silk thread are not duplicated in the output of any collector represented in this museum, and we have samples of the work of most of the oldtimers.

"Both the skins reached your museum, evidently, as part of the collection of Ned Hollister, once of Delavan, Wisconsin. The numbers and initials on the backs of the labels are definitely in Hollister's

handwriting, which I know well. I used to trade specimens with him myself. He knew Western literature, and no 'good' record like that of Tree Sparrow from *California* would have escaped him. He would have recorded it!

"The original number on the tree sparrow label proves not to be of the check lists of the AOU, of Baird, of Coues, or of Ridgway. Clearly it was a private number and betokens a collector of considerable attainment. Again, I cannot guess who it might have been among members of the Cooper Ornithological Club along about 1896.

"True, there is an Enterprise in Butte County, California, but—there are also *two* Enterprises in Colorado, though I find no 'Butte County' on any current map of that state. There *might* have been, however, when mining was more active back in the '90's. Tree sparrows are, of course, common winter visitants to Colorado.

"Under the circumstances set forth above you will see why I hesitate to accept the Hellmayr records of *Spizella arborea* for California. A correction should be made. Will you do it?"

I have been unable to find another specimen in the collection of the Field Museum with a label similar to that on the Tree Sparrow. From comparison of the letters of the word "sparrow" on the original label, the state abbreviation given seems to be definitely Cal. rather than Col.; and there is no Butte County for Colorado in the postal guide of 1891, or on a map of that state dated 1897, that I have consulted. The fact remains that Hollister wrote his initials and number on the back of a label saying "Western Tree Sparrow. Enterprise, Butte Co., Cal." without indicating that he questioned the data.

The skin from Hayward listed as *Spizella arborea ochracea* is that of an immature *Zonotrichia leucophrys pugetensis*. When the Field Museum label was attached in 1911 at the time the collection was acquired, the bird received this name, but this was a *lapsus calami*, for on the original tag it was properly identified. It is well to mention here, as Hellmayr did in the prefaces to parts eight and eleven of the Catalogue of Birds of the Americas, that in the parts prepared since 1931 when he returned to Austria, Dr. Hellmayr never examined many of the specimens recorded. Often the persons preparing the list of specimens for him took the identifications directly from the labels with no attempt to check them. It is much better to speak of "specimens listed in Hellmayr's catalogue" than of "specimens recorded by Hellmayr."—SIDNEY CAMRAS, *1418 S. Karlov Avenue, Chicago, Illinois, August 2, 1940.*

A Bird's Nest Made of Paper.—While at the Green Valley Falls picnic grounds, Solano County, California, on May 19, 1940, Mr. J. D. Graham of Benicia and I found a nest that was built almost entirely of paper (fig. 82). It was situated six feet from the ground in the lower limb of a laurel tree along Green Valley Creek. The major portion of the material with which it was constructed was found to be "Kleenex," as certified by the manufacturer of that product to whom a sample was sent for examination. In addition to this paper, a few vegetable fibers were employed about the rim and for lining.

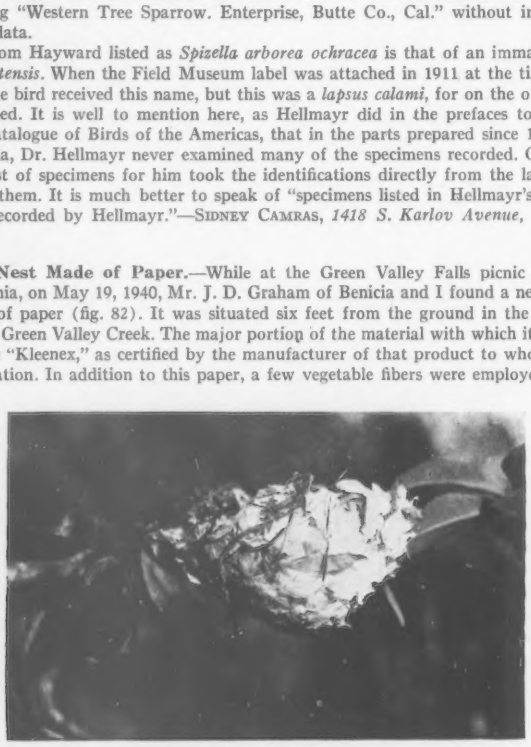

Fig. 82. A vireo's nest constructed primarily of paper; Solano County, California.

The nest was not occupied and no bird was about. However, both Warbling and Cassin vireos nest in this valley, and the nest was that of one of these two species. I have placed the nest in my collection.—EMERSON A. STONER, *Benicia, California, June 11, 1940.*

An Apparently Authentic Record of the Spectacled Eider for California.—Through the instrumentality of Mr. G. H. True, Jr., Economic Biologist of the California State Division of Fish and Game, the California Academy of Sciences has recently come into possession of the well preserved skin of the head of an adult male Spectacled Eider (*Arctonetta fischeri*). This fragment permits of unmistakable identification. The specimen was recently brought to Mr. True by Assistant Fish and Game Warden D. O. Sellick who advised that his father, Mr. O. F. Sellick of Bitterwater, San Benito County, California, shot the bird on Bitterwater Lake in February, 1893. At that time, Mr. Sellick senior recognized that the duck was an unusual one, so he skinned and preserved its head. The fragment is now preserved as no. 57547 of the ornithological collection of the California Academy of Sciences.

Unusual as this record is, for the species in question is an exceedingly northern one which winters in the Aleutian Islands and has, we believe, not previously been recorded from south of Sanak Island, Alaska, there does not appear to be any reason to doubt its authenticity. Further, the Messrs. Sellick are reported to be entirely reliable observers.

Possibility that the specimen was one escaped from captivity has been considered and deemed too unlikely for acceptance since we believe that this eider has never been kept in captivity in America and almost certainly not so early as 1893. It appears to be more likely that the bird was simply an exceptional wanderer, but in this case the fact that it was fully adult is more unusual than if it had been a young of the year. Previous to this record, we know of only three occurrences of eiders in California and these all of the King (*Somateria spectabilis*); the Pacific Eider (*S. mollissima v-nigra*) has been recorded as a casual visitor to the coast of Washington.—James Moffitt, *California Academy of Sciences, San Francisco, September 19, 1940.*

Records of the Tule Wren and Black-footed Albatross in Oregon.—Gabrielson and Jewett (Birds of Oregon, 1940, p. 458) state that there is only one known set of eggs of the Tule Wren taken in Oregon and that (p. 80) there are only a few sight records of the Black-footed Albatross for the State. It may be added that on June 8, 1940, four occupied nests of the Tule Wren (*Telmatodytes palustris paludicola*) were found in a marsh on Beaver Creek, Lincoln County, only one-half mile back from the ocean. The first nest had three fresh eggs, the next, five, the third, six young birds half feathered out, and the last, six badly formed eggs. All the occupied nests were twice as long as broad and all empty ones were globular. The nests were anywhere from six inches to three feet above the ground. On July 28, 1940, the writer obtained a female Black-footed Albatross (*Diomedea nigripes*) on the beach at Otter Rock. The gulls and sand fleas had started to work on it but I was able to prepare a study skin which was sent to Mr. Jewett for his collection.—H. H. Hann, *Otter Rock, Oregon, July 29, 1940.*

NOTES AND NEWS

The September, 1940, issue of "California Bird News" (vol. 5, nos. 2 and 3, p. 2), mimeographed periodical issued by the California office of the Division of Wildlife Research, Federal Fish and Wildlife Service, contains the following paragraph.

"In 1939 six white-tailed kites were banded by a cooperator near Watsonville. Before December 31, 1939, bands of three of the six had been sent in, shot by residents of the area. This small hawk, which to the average layman looks something like a small sea gull, is considered so uncommon that the legal taking of a specimen requires a special permit from the Division of Fish and Game; possibly the results of the 1939 banding indicate one of the major causes of its scarcity."

Realizing that ignorant or wanton shooting of this beneficial bird is a considerable factor in its depletion, Mr. Laidlaw Williams and I have for several years advocated an attractive poster which would point out the bird's recognition marks and make a plea for its preservation. The National Audubon Society has heeded our requests for such a poster and is now preparing one for distribution in California. My experience with duck hunting clubs where kites are numerous is that the members are anxious to protect the birds when they learn of their good habits and depleted numbers. Hence, it is thought that broader education, along these lines, of individuals likely to see kites will work for the birds' protection.

It is hoped that the Audubon Society posters will be ready for distribution by January 1, 1941. It is planned to place them in as many duck hunting clubs as possible, in places where hunting and fishing boats are rented in kite territory, in farm houses near which kites nest, and in our schools. Thus, a general plan of education may result, with decided benefit to kites. It is hoped that Federal and State game wardens may assist in distribution of the posters, for this will help to interest the enforcement officers in the plan to preserve this attractive species.—JAMES MOFFITT, *California Academy of Sciences, San Francisco.*

Beginning with the next issue of The Condor in January, 1941, the form for citation of literature will be changed and simplified. The style to be adopted is in accord with current practice in a number of scientific journals and consists primarily of the use of a colon to separate volume (and year) from the page number, thus doing away with the abbreviations "vol." and "p." An example of a text citation to an article appearing in a journal would be: (Condor, 42, 1940:310). In keeping with this system, a particular reference to a statement in a paper listed in a terminal bibliography would be: Lack (1940:275). The full citation in the terminal bibliography would be: Lack, D. [next line] 1940. Pair-formation in birds. Condor, 42:269-286. Volume numbers should always be in Arabic rather than Roman numerals, except where, for bibliographic completeness the author wishes to show the style of numeral employed in the publication cited. Contributors to The Condor will relieve the editors of much work if they will observe these matters of form.—A.H.M.

MINUTES OF COOPER CLUB MEETINGS

NORTHERN DIVISION

MAY.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, May 23, 1940, at 8 p.m., in room 2503 Life Sciences Building, Berkeley, with President Painton in the chair and about 40 members and guests present. Minutes of the Northern Division for April were read and approved. Two names were proposed for membership: Robbins S. King, Box 243, Cupertino, California, by Marion Jo Theobald; Lloyd P. Tevis, Jr., Box 1416, Carmel, California, by J. M. Linsdale.

Report for the Conservation Committee was made by B. C. Cain, chairman. There has been much interest in the Berkeley Aquatic Park, especially since new funds have been made available for its development. Continued interest by club members will be helpful in maintaining there the important waterfowl habitats, as has been done in the past. It was suggested that an additional member on the committee would be desirable, on account of absences of other members during the summer. Mr. Frank G. Watson was appointed.

Mr. Alden Miller brought to the meeting a copy of "Birds of Oregon," by Gabrielson and Jewett, so that members might have an opportunity to look at it.

Mr. R. M. Bond gave a detailed account of the birds seen on a recent week's trip to Santa Barbara and Anacapa islands; 450 young Brown Pelicans were banded on Anacapa. He also stated that there is an apparent decrease in White-tailed Kites this year, both in Santa Cruz and Ventura counties. Milton Siebert had observed a pair of mockingbirds nesting in the Maxwell Park district of east Oakland, May 15. David Nichols told of his observations of the Black-crowned Night Herons which arrive at the Aquatic Park in the early evening, after having roosted elsewhere during the day. Mr. Emlen described some effects of the late spring rains on bird life in the Sacramento Valley. Some of the heron colonies

are empty, having been under 7 feet of water until recently. Delayed plowing and flooding of rice fields has resulted in disaster to pheasants caught at the height of their nesting season. Ducks, however, have done very well, as indicated by an increase of Mallards, a few Cinnamon Teal and more Blue-winged Teal. Miss Rinehart had found a Bullock Oriole, apparently nesting, on Bay Street, Alameda, and Mr. Cain added the record of a pair in Dimond Park. Mrs. Bracelin said that the Anhinga was again to be seen at Lake Merced, San Francisco, in the same area which it frequented last year.

"The Breeding Cycle of the White-tailed Kite" was the topic presented by Mr. Frank G. Watson. The kite, he pointed out, is a bird of marsh or farm land, requiring a sheltered spot for nesting (usually a willow tree), and good open country for foraging. He recounted the routine of activities of a typical day for the kites, and described territorial behavior, pairing and nesting, foraging by the male during courtship and early incubation.

Adjourned.—FRANCES CARTER, *Recording Secretary.*

JUNE.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, June 26, 1940, at 8 p.m., in room 2503 Life Sciences Building, Berkeley, with President Painton in the chair and 35 members and guests present. Minutes of the Northern Division for May were read and approved. Minutes of the Stanford Chapter were read in part. Names proposed for membership were: George (Bell) Dyer, Diabase Farm, New Hope, Pennsylvania, by Curtis Wright; Mrs. Harry R. Painton, 1000 Cowper Street, Palo Alto, California, by Harry R. Painton.

The meeting was devoted to pictures and summer field notes. Mr. and Mrs. H. H. Bailey, of Coral Gables, Florida, showed some of their motion pictures of birds. Of particular interest to the club, because of recent reports on the White-tailed Kite, were pictures of nesting Swallow-tailed Kites. The nest, of Spanish moss and cypress or oak twigs, is placed high in a spindly pine. Wood Ibis, Anhingas, Pelicans, Florida Cormorants and Roseate Spoonbills were among those shown. There were many studies of nests with eggs or young birds. The habitats found within the Everglades include wide areas of sawgrass, water ways with large masses of vegetation or "floating islands," mangrove swamps and the "Big Cypress" which is the jungle of tall trees.

Mrs. Bailey opened field notes with some of her experiences with bird banding in Florida. Unfortunately, there are only five banders in the entire state, but she hopes to arouse interest in banding through various bird clubs. Dr. Loye Miller supplemented material on kites with a note on the finding of fossil remains of a White-tailed Kite in a Pleistocene cavern of eastern Mexico. He also referred to the work of Tom Rodgers on the sound produced by the tail feathers of the male Anna Hummingbird, and told of hearing a feeble sound which could not be mistaken for a vocal tone, made by the tail feathers of young birds of the year, at the Tucker's sanctuary in the Santa Ana Mountains.

Joe Marshall discussed the finding of birds in the wrong life zones and opened the question of the possible role of these waifs as pioneers in determining the fate of the species. Tom Rodgers described nests of Cliff Swallows at Bass Lake. He recalled that two years ago at the Life Sciences Building, there were evidences of young birds having been left to perish in the nests, and wondered whether the instinct of migration might overcome that of feeding the young, at the end of the season. R. M. Bond compared conditions at Pyramid Lake, Nevada, with those found by E. R. Hall ten years ago. Diversion of water from the Truckee River has resulted in a marked drop of the lake level and a decrease in numbers of gulls, pelicans and cormorants. Ray Alcorn added that with the lowering of Pyramid Lake had come a transfer of California Gulls and Caspian Terns to Lahontan Reservoir.

Adjourned.—FRANCES CARTER, *Recording Secretary.*

JULY.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, July 25, 1940, at 8:00 p.m., in Room 2503 Life Sciences Building, Berkeley, with President Painton in the chair and about 120 members and guests present. Minutes of the Northern Division for June and the Southern Division for May were both read in part. Three proposals for membership were read: Virgil Darwin Allread, Box 302, Fair Oaks, California; Ewin G. England, Box 22, Durham, California; Miss Evelyn H. Thomas, 382 Kenoak Drive, Pomona, California; all submitted by Lloyd G. Ingles.

Mr. Milton Ray reported an unsatisfactory season for field work in the high Sierra. Early in May, there was more snow at Lake Tahoe than had been found in twenty-five years; then it suddenly turned warm and the snow disappeared, but abundant bird life was not to be observed. On an eastern trip, he visited the home of Benjamin Hogue, collector and taxidermist, at Stephentown, New York, and Mrs. Hogue let him have some material taken by an old-time Californian, Chester Barlow.

The speaker of the evening was Dr. Sarah R. Atsatt, of the Department of Zoology at the

University of California at Los Angeles, who spent from September, 1939, to January, 1940, traveling through southern and central Africa. Excellent museums were visited in South Africa and at Nairobi in British East Africa. In the Belgian Congo, she spent some time in the Krueger National Park, photographing wild-life and habitats. In beginning the study of African birds, she found it necessary to change her concept of certain families, as for example the shrikes, which include at least 38 African species, not all limited in color to black and white. Common names frequently proved to be in native dialects. Also, they often presented a confusing combination of familiar terms, such as wren-warbler, cuckoo-shrike, hawk-eagle, eagle-owl and flycatcher-warbler.

The Walking Eagle, or Secretary Bird, is well distributed in central Africa. The Roller corresponds to the blue jays in behavior and sound. Sunbirds replace our hummingbirds and are brilliant, with malachite or crimson coloring flashing against the poinsettias which are abundant in South Africa.

Dr. Atsatt concluded her talk with a series of beautiful Kodachrome pictures which she had taken, showing the landscape, the characteristics of the towns and the types of vegetation. In describing each habitat, she mentioned the kinds of birds seen there.

Adjourned.—FRANCES CARTER, *Recording Secretary.*

AUGUST.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, August 22, 1940, at 8:00 p.m., in Room 2503 Life Sciences Building, with President Painton in the chair and about 100 members and guests present. Minutes of the Northern Division for July were read and approved. Thomas J. Trelease, Steiner Apartments, Sparks, Nevada, was proposed for membership in the club by Susan E. Chattin. All further business was postponed, in order to devote the remainder of the time to the speaker of the evening.

Mr. Ed N. Harrison, of Encinitas, California, showed several reels of his photographic life history studies of birds, in natural color. Whenever possible, he has attempted to get a complete sequence from a single nest, but there are times when accidents to nest, young or parents make it necessary to continue the study in following years. Pictures taken in Oregon showed nesting of California Murres, ducks, Avocets, Canada Geese and White Pelicans. There were some particularly fine portraits of American Egrets. In the Mammoth Lake region, Mrs. Frances Roberts, who assisted him, had made some beautiful close-up studies of the Sierra Junco, Modoc Song Sparrow and Pileolated Warbler, all difficult because of the dense shade of the surroundings.

One of Mr. Harrison's most complete studies is that of the Red-bellied Hawk, in San Diego County. The motion pictures were so taken that the concrete highway far below often made a light background against which the nest and young, high up in a eucalyptus, showed to excellent advantage. His pictures of the California Condor were taken in cooperation with Mr. J. R. Pemberton and gave some additional chapters in the biography of the famous young "Oscar." Bits from work on the Bald Eagle and the Long-eared Owl were also shown. The series on the Golden Eagle was another record remarkable in its completeness.

Adjourned.—FRANCES CARTER, *Recording Secretary.*

SOUTHERN DIVISION

MAY.—The annual outdoor meeting of the Southern Division of the Cooper Ornithological Club was held at the Dorothy May Tucker Memorial Bird Sanctuary at Oakwood in Modjeska Canyon, near Orange, California, on Sunday, May 26, 1940. A short business meeting was called to order at 1:30 p.m. by President Robert T. Moore, with about 45 members and guests present.

The minutes of the April meeting were approved as read. The January, February, and March minutes of the Northern Division meetings were read by title. Four applications for membership were read as follows: Granville Plummer Ashcraft, 3216 Watseka Avenue, Palms Station, Los Angeles, California, proposed by Alden H. Miller; M. Palmer Stoddard, 309 N. Crescent Drive, Beverly Hills, California, by C. V. Duff; Norman H. Hill, 5 Manor Circle, Takoma Park, Washington, D. C., and William Geo. Vowels, 1221 West 46th Street, Los Angeles, California, by George Willett.

President Moore introduced the Club's host, Mr. B. F. Tucker, who gave a brief account of the history of the canyon and his bird-attracting activities of the last sixteen years. The ease and clarity with which club members could observe the hummingbirds at the automatic feeders just outside the porch windows was appreciated by all. The Anna, Costa, and Black-chinned hummingbirds are known to nest and winter in the canyon while the Allen and Calliope have been seen in the summer months. It is Mr. Tucker's opinion that the young of the Black-chinned and Costa hummingbirds stay on during the winter because of their dependence on the artificial food, since they have not yet acquired a taste for, or learned where to find, the wild nectar. The courtship antics of the hummingbirds have provided a fascinating study for the Tuckers and their

friends. Mr. Tucker reported that usually the female builds the nest but sometimes coöperative nest building has been observed. Annoyances from other animals included forays on the food by ants and bees, and destruction of the birds by cats. The ants have been kept from the feeders by oil funnel traps built around the suspension wires. When the bees begin to steal the artificial honey, they will not go back to wild honey; perforated metal shields over the open dish of sweet water and an electrical shocking device improvised by Mr. Tucker solved this problem. Mr. Tucker claimed that his interest had been maintained through the active coöperation of his wife, the late Dorothy May Tucker, and the encouragement of bird enthusiasts. His clear presentation of facts before the Cooper Club members revealed his deep personal interest in the birds.

A motion initiated by George Willett and seconded by Dr. Louis B. Bishop, expressing appreciation for Mr. Tucker's kindly hospitality and for his summary of the creative work of the sanctuary was unanimously carried.

Adjourned.—SHERWIN F. WOOD, *Secretary.*

JUNE—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at the Los Angeles Museum, Tuesday, June 25, 1940, with Vice-president Hildegarde Howard in the chair and 20 members and guests present.

The minutes of the May meeting of the Southern Division were approved as read, after which the April minutes of the Northern Division were read. Two applications for membership were read as follows: Lloyd Mason Smith, Rainbow Forest Museum, Petrified Forest National Monument, Holbrook, Arizona, proposed by W. Lee Chambers, and Clair Steggall, 2809 Marsh Street, Los Angeles, California, proposed by Loye Miller.

A letter from Mr. Oscar F. Clarke of Colton, California, was read, proposing the formation of a chapter at Colton to be known as the San Bernardino Valley Chapter of the Cooper Ornithological Club with Mr. W. C. Hanna as adviser. On motion by John McB. Robertson, seconded by Gilbert Benjamin, the Southern Division went on record as favoring the formation of the chapter.

Dr. Hildegarde Howard called the attention of members to two new books, Peters', Check-list of Birds of the World, vol. 4, and Todd's Birds of Western Pennsylvania. Mr. John McB. Robertson remarked about the apparent indifference to war shown by the absence of war references in recent discussions in the Proceedings of the British Ornithological Club.

Mr. Robertson had observed the nest of a pair of Blue Grosbeaks in Orange County built in a sunflower plant about three and one-half feet above the ground. Mr. William Vowels reported seeing Violet-green, Barn and Cliff swallows at Sespe Canyon recently. Mr. Gilbert Benjamin reported a Golden Eagle at Virginia Lakes.

Mr. Howard Cogswell reported seeing a flock of Evening Grosbeaks on March 23 at Big Bear Lake as well as Canvas-backs, Redhead, Scaup and Ring-necked ducks. He reported two male and three female Ring-necked Ducks wintering at Devil's Gate Dam near Pasadena.

Miss Ida DeMay reported recovery of bones of many recent birds from the Carpinteria asphalt deposits and commented upon the interesting observations of Dr. Loye Miller on the San Josecito collection of fossil birds from Mexico. Mr. Robert Sanders reported an unusual nesting site of House Sparrows on First Street, Los Angeles, above a sign in front of the Times Building. Mr. Clair Steggall had observed Golden Eagles, Sierra Juncos, White-throated Swifts, Purple Martins, Red-tailed and Cooper hawks, Black-throated Gray Warblers, and Hutton and Cassin vireos in the Santa Ana Mountains. Mr. Sam Hinton reported on the dexterity of Road-runners in robbing the reptile pits at U. C. L. A.

Some discussion followed concerning measures to take in preventing spraying and treatment of trees and shrubs at times when nesting birds were in them. It was felt that individual pleas probably would help to save some birds.

A motion, to be transmitted to the Board of Supervisors of Los Angeles County, that the club go on record in favor of making the Nigger Slough region into a wild-life area rather than a recreational area was initiated by C. V. Duff, seconded by John McB. Robertson, and unanimously carried.

Mr. John McB. Robertson reported more nesting pairs of Cassin Kingbirds than usual in western Orange County. He stated that a few usually stay all winter. Dr. Hildegarde Howard reported a tragic ending to the nesting efforts of Killdeer on the fourth floor roof of the Los Angeles Museum Building, despite attempts to help them.

Adjourned.—SHERWIN F. WOOD, *Secretary.*

JULY.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at the Los Angeles Museum, Tuesday, July 30, 1940, with Vice-president Hildegarde Howard in the chair and 20 members and guests present.

The minutes of the June meeting of the Southern Division were approved as read. The May minutes of the Northern Division were read by title. Two applications for membership were read as follows: Lieut. Comdr. Deill Phillips, *U. S. S. Louisville,* c/o Postmaster, San Pedro, California,

and Gerald Eugene Sedgewick, 71 North Pleasant Avenue, Ridgewood, New Jersey, both proposed by W. Lee Chambers.

Dr. Howard introduced the speaker, Dr. Carlton M. Herman, of the Zoological Society of San Diego, who spoke on bird diseases. Dr. Herman pointed out that there were at present two important sources of information, namely, studies on poultry and investigations of game birds. He discussed briefly common diseases such as pneumonia, duck sickness or botulism, vitamin deficiencies, lead poisoning and enteritis. He emphasized the possible danger of introducing foreign quail into new areas without previous knowledge of the bird's parasites, especially those with quail enteritis. Whole populations may be wiped out in a few days by this infection due either to an absence of immunity or to a lack of sufficient immunity from previous contacts with the causative agent. In discussing a protozoan intestinal parasite, *Coccidium*, causing a disease that is spread by contamination, he stated that House Sparrows succumb quickly to this infection when crowded in a small cage. He suggested that this situation may be one of the contributing factors that account for the necessity of territories in some species of birds.

Dr. Herman was active in the bird disease study project organized in 1937 by Dr. C. Brooke Worth and the Eastern Bird-banding Association. Their first report in 1938 involved the work of six cooperators on 23 birds. In 1939, there were eight cooperators who examined over 200 birds, and in 1940, ten cooperators have handled nearly 500 birds. Among the more important findings were a diphtheria-like disease in wild passeriform birds, tumors of birds caused by a number of disease-producing agents, and a virus disease transmitted by food contamination in doves. Dr. Herman suggested that a virulent form of this virus disease of the Columbiformes could possibly help to explain such rapid disappearances as that of the Passenger Pigeon.

Mr. W. A. Kent reported over 200 pairs of eared grebes nesting at Big Bear Lake.

Mr. George Willett reported that in the plains country of northeastern Colorado he noticed two very common birds, Horned Larks and Lark Buntings. The Horned Larks were so abundant that they swarmed like bees in front of the car, making it impossible to avoid running over them. He reported that in the mountains at 12,000 feet, two pipit's nests were found, each with five eggs, and that lower down along the banks of highway cuts, four occupied nests of Townsend Solitaire were seen. In eastern Colorado, near Lamar, he found nests of Brown Thrasher, Eastern Kingbird and Western Mockingbird in a small grove of trees. There was an American Magpie nest near the nest of an Eastern Kingbird and every time the magpie left or returned, the kingbird accompanied it or met it fifty yards from the nest.

Mr. F. G. Crawford reported an apparent mass desertion of Tricolor Red-wing nests at Nigger Slough during the first week in May, although the water level had remained about the same during their nesting period.

Adjourned.—SHERWIN F. WOOD, *Secretary*.

AUGUST.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at the Los Angeles Museum, Tuesday, August 27, 1940, with Vice-president Hildegarde Howard in the chair and 70 members and guests present.

The minutes of the July meeting of the Southern Division were read and approved. The June minutes of the Northern Division were read by title and the July minutes were read in part.

A letter to W. Lee Chambers from John H. Baker, Executive Director of the National Association of Audubon Societies, was read, announcing the employment of Bert Harwell as representative of the Association in California.

Mr. John McB. Robertson called attention to a note by the editor in the July, 1940, issue of Avicultural Magazine reporting the complete destruction of the bird collection of Captain Jean Delacour in France.

Dr. Howard introduced the speaker, Mr. Eugene O. Murman, Glendale artist, who illustrated his lecture on the birds of paradise with excellent hand-tinted lantern slides. Mr. Murman cooperated closely with naturalists while attempting to portray accurately these birds in their native haunts during his four-year study of them. He pointed out that although birds of paradise were reported in 1522, very little is known today of some one hundred different species found chiefly in Australia, New Guinea and adjacent islands. About 40 species were illustrated in color. Several slides of a single species were shown to depict the elaborate displays of the male birds. A lively discussion followed the lecture relative to the natural history of the birds and to the technique of preparing the slides.

Mr. W. A. Kent, during a Los Angeles Audubon Society field trip ten miles off shore, under the leadership of George Willett, reported observing the following: Black-footed Albatross, Sooty and Pink-footed shearwaters, Xantus Murrelet, Sabine Gull, Black Petrel, Brandt and Farallon cormorants, Parasitic and Pomerine jaegers, and Common Tern.

Dr. A. W. Bell reported seeing Rosy Finches in the Sierras at 9000 feet in the Kern River country. He also reported the presence of California Thrashers in his backyard, several miles from chaparral.

Adjourned.—SHERWIN F. WOOD, *Secretary*.

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